This report is prepared in advance of the annual meeting of the North Central Weed Control Conference. It consists of abstracts and summaries of recent research on many phases of weed control and represents the combined efforts of 129 individual contributors. Data have been collected on the use of 52 chemicals, the control of 135 species of herbaceous weeds and 42 woody species, and the reaction of 58 crops to treatment with many of these chemicals. The data were summarized and this report was assembled in less than 30 days, by the 28 members of the Research Committee. The report is intended to serve as a timely source of information for persons engaged in research, extension, regulatory, and industrial work and others interested in weed control work. Lyle A. Derscheid, Chairman, Research Committee.

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RESEARCH COMMITTEE-1953

Chairman-Lyle A. Derscheid, Department of Agronomy
South Dakota State College, College Station, So. Dak.

Quack or Couch Grass- A. C. Carder, Dominion Experimental Station, Beaverlodge, Alberta, Canada.

Johnson and Bermuda Grasses- W. C. Elder, Agronomy Department, Oklahoma A & M College, Stillwater, Oklahoma.

Canada and Perennial Sow Thistles- C. J. Willard, Department of Agronomy, Ohio State University, Columbus, Ohio

Leafy Spurge- H. E. Wood, Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Manitoba.

Field Bindweed- J. W. Zahnley, Agronomy Department, Kansas State College, Manhattan, Kansas.

Hoary Cresses and Russian Knapweed- Neal E. Shafer, Agronomy Department, University of Nebraska, Lincoln, Nebraska.

Toadflax and Other Herbaceous Perennial Weeds- H. A. Friesen, Dominion Experimental Station, Scott, Saskatchewan.

All Annual, Winter Annual and Biennial Weeds- R. S. Dunham, Department of Agronomy and Plant Genetics, University Farm, St. Paul, Minnesota.

Aquatic Weeds and Cattails- B. H. Grigsby, Department of Botany, Michigan State College, East Lansing, Michigan.

Spring Sown Grain- Neal E. Shafer, Agronomy Department, University of Nebraska, Lincoln, Nebraska.

Fall Sown Grain- W. M. Phillips, U. S. D. A. Weed Investigations, Hays Experiment Station, Hays, Kansas.

Flax- R. G. Robinson, Department of Agronomy and Plant Genetics, University Farm, St. Paul, Minnesota.

Corn- D. W. Staniforth, Department of Botany and Plant Pathology, Iowa State College, Ames, Iowa.

Sorghum- W. C. Elder, Agronomy Department, Oklahoma A & M College, Stillwater Oklahoma.

Peas and Soybeans- F. W. Slife, Agronomy Department, University of Illinois, Urbana, Illinois.

Leguminous Forages- J. H. Miller, U. S. D. A. Weed Investigations, Department of Agronomy and Plant Genetics, University Farm, St. Paul, Minnesota

Sugar Beets- E. A. Helgeson, Department of Botany, North Dakota Agricultural College, Fargo, North Dakota.

Grasses, including Pastures and Ranges- D. L. Klingman, U. S. D. A. Weed Investigations, 108 Waters Hall, University of Missouri, Columbia, Missouri.

Onions, Potatoes and Sweet Corn- R. E. Nyland, Department of Horticulture, University Farm, St. Paul, Minnesota.

Other Vegetable Crops- W. F. Warren, Department of Horticulture, Purdue University, Lafayette, Indiana.

Small Fruits, Ornamental Shrubs and Flowers- L. G. Holm, Department of Horticulture, University of Wisconsin, Madison, Wisconsin.

Turf- B. H. Grigsby, Department of Botany, Michigan State College, East Lansing, Michigan.

Control of Brush on Roadsides, Utility Lines and other Rights of Way- R. H. Beatty Agricultural Chemicals Division, American Chemical Paint Co., Ambler, Pennsylvania.

Control of Brush on Rangeland and Pastures- H. M. Elwell, B. P. I. S. & A. E., U.S. D. A., Box 465, Guthrie, Oklahoma.

Control of Brush in Forest, Tree Plantations and Farm Woodlands- Henry L. Hansen, School of Forestry, University Farm, St. Paul, Minn.

Control of Woody Plants in other Problem Areas, including Alternate hosts and Poisonous Plants- L. W. Melander, Entomology and Plant Quarantine, 301 Metropolitan Building, Minneapolis 1, Minnesota.

Defoliants and Pre-harvest Weed Control- W. M. Phillips, U. S. D. A. Weed Investigations, Hays Experiment Station, Hays, Kansas

New Herbicides- W. C. Dutton, Library Building, Dow Chemical Company, Midland, Michigan.

Mechanical Considerations, including Aerial Operations- R. E. Larson, Agricultural Engineering Building, University of Missouri, Columbia, Missouri.

Basic Problems- W. E. Loomis, Department of Botany and Plant Pathology, Iowa State College, Ames, Iowa.

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QUACK OR COUCH GRASS

Summary

A. C. Carder

Abstracts submitted indicate a swing towards the use of chemicals combined with cultivation. One abstract delt with the use of cultivation alone and one using cultivation with a combination of chemicals. Eleven references were made to work with CMU, 5 with TCA, 4 with a, a dichloropropionic acid (Dalapon), and 2 with MH. Other chemicals reported on were CIPC, phenyldimethylurea (PDU) and paraphenoxyacetic acid.

TCA -- Information largely substantiates that of previous years, although somewhat heavier rates were required for effective removal than formerly experienced. This may be because the current reports with TCA were received from drier regions of the area served by the Conference. Cultivation continued to greatly increase the effectiveness of the herbicide.

CMU -- Results substantiate last year's observation that cultivation does not enhance the killing action of CMU, although one report refers to increased kill when a light rate of CMU was used. Complete to almost complete kills were obtained by 20-40 pounds per acre of the chemical according to region. At over 20 pounds normal development of crop plants was prevented for at least two years.

MH -- Proved promising when combined with seed-bed preparation. Eight pounds MH per acre would seem sufficient.

DALAPON-- Promising as based on a single season's results. One report indicates clipping before or cultivation after treatment not beneficial to its action. Twenty pounds per acre suggest strong lethal effect.

OTHER CHEMICALS -- PDU on a single season's results acted almost identical to CMU. CIPC and paraphenoxyacetic acid were not effective at rates used.

Abstracts

Residual effect of CMU. 1953. Brown, D. A. A dense stand of couch grass was treated in June 1951 with CMU at rates of 20, 40, 60 and 80 lb./A. active ingredient. Grass was completely killed at all rates and several sickly alfalfa plants constituted the only vegetation on the experimental area in May 1952. The surface was tilled late in May and the following crops were seeded, - wheat, oats, barley, flax, corn, potatoes, beans, beets, carrots, lettuce, peas, pumpkin, radish and tomato. All these crops made normal stands of seedlings that lived ten days to two weeks then died. Several plants of carrots, peas, beans and flax made stunted growth on plots receiving the 20 lb. rate, but these succumbed before mid-summer. Potatoes grew only until food supplied by tuber was exhausted. In May 1953 the plot area was tilled and the same selection of crops seeded. Complete sterility continued on plots that had received 60 and 80 lb./A. Soil treated at 20 lb/A. sustained growth throughout the

summer which was recorded in percentage stand of normal crop as follows - flax 30%, corn 24%, wheat, oats and barley 15%, carrots 60%, peas and beans 55%, beets 50%, potatoes 25% and radish 15%. Soil treated at the 40 lb. rate permitted only tufted growth of carrots, beets and peas until mid-summer when all cultivated crops died. By the autumn of 1953 a good growth of sweet clover, Russian and red-root pigweed and green foxtail developed on plots at the 20 lb. rate and lesser amounts at the 40 lb. rate. Plots at the 60 and 80 lb. rate passed through the 1953 growing season completely free of any plant growth. (Contribution of Experimental Farm, Brandon, Manitoba.)

Chemical control of grassy weeds 1953. Brown, D.A. Annuals. Complete control of green foxtain in seedling stage, growing in crops of flax has been obtained with application of TCA as low as 3 lb./A. and CMU at 1 lb./A. Flax was three inches high when treated and it sustained no injury from the TCA up to 10 lb./A. but CMU in excess of 3/4 lb./A. caused injury.

Couch Grass. Well established stands were treated June 12 with CMU 40 lb/A. Dalapon 40 lb/A. and Compound 2049 at 20, 40, 60, and 80 lb/A. All were applied in a water spray using one gal. per pound of chemical powder. Dalapon killed above ground growth rapidly. The action of CMU and Cpd. 2049 was almost identical. Killing was slow but two months after application kill of above ground growth was complete except in plots treated with 20 lb/A. Cpd. 2049. Notes taken late in October indicated a 100% kill of the grass at the 40 lb and above rate. Kill at the 20 lb. rate of Cpd. 2049 was rated at 85%. Couch grass plots treated with TCA at 25, 50, 75, 100 lb/A. and CMU at 20, 40, 60 and 80 lb/A. in 1951 and 1952 appeared as follows in 1953. Regrowth 90% TCA at 25 lb. down to 60% regrowth at 100 lb/A. CMU at all rates gave 100% kill but left the soil completely sterile for at least two years. (Contributed by Experimental Farm, Brandon, Manitoba)

Control of quackgrass and annual weeds in corn with herbicides. Buchholtz, K. P. Plots 13 by 50 feet were established on a sod area heavily infested with quackgrass. MH, as the sodium salt, was applied to specified plots at the rate of 8 lbs/A on May 12, when the quackgrass had a leaf growth of about 6 in. Water equivalent to 20 gals/A was used with four replications. On May 15, the area was plowed and on May 20, was drilled to corn hybrid 416AA in rows 40 in. apart. Pre-emergence applications consisted of CMU at 2 lbs/A and an amine salt of DNBP at 6 lbs/A, each applied on 2 of the 4 replications. The CMU was applied on May 22, and the DNBP on May 30, when the corn was starting to emerge. Counts of quackgrass shoots were made on June 11, and counts of annual weeds on June 17, before any of the plots were cultivated. Plots receiving cultivation were tilled three times during late June and early July. Weed infestations were heavy on the check plots and could not be controlled completely by tillage. This resulted in some competition with the corn both before and after the cultivations were started. At maturity the grain was harvested. Data are shown in the table.

Treatment	Quack shoots Number/sq.ft.	Annual weeds/sq.ft.		Grain Yield
		Grasses	B.L.	Bu/A
Check -- 3 cult.	24.9	9.3	4.6	53.0
Pre-emergence	30.8*	0.5**	0.1**	44.3
MH	1.8**	11.4	5.0	33.3**
MH + 3 cult.	3.6**	8.7	4.0	62.9*
Pre-emer. + 3 cult.	28.6	0.4**	0.2**	61.7
MH + pre-emergence	1.8**	1.3**	0.3**	63.1*

*Sig. different from check at 5% level.

The pre-emergence treatments alone controlled annual weeds adequately during the season but growth of quackgrass was severe enough to reduce corn yields materially on plots that received only this treatment. Plots given MH treatments had little quackgrass but growth of annual weeds was sufficient to reduce corn yields sharply. Maximum yields of corn were obtained when MH or pre-emergence treatments were combined with cultivation or when both MH and pre-emergence treatments were used. Plots receiving the latter treatment were essentially weed-free throughout the season. (Dept. Agron., Univ. of Wisc., Madison, Wisconsin)

The effect of CMU on quack grass (Agropyron repens), 1952-53. Burrows V. D. and Olson, P. J. Six 12 ft. x 12 ft. plots were laid out on a solid stand of Agropyron repens and treated with 0, 5, 10, 25, 50 and 100 lbs active ingredient/A. Two replications were used. The treatments were applied when the Agropyron repens was 9 - 12 in. tall. Two weeks after application the plots treated with 50 and 100 lbs. were stunted and burned while those treated with 10 and 25 lbs. were lodged and slightly burned. The quack grass treated with the 5 lb. rate was only slightly less vigorous than the check. In the fall of 1952 the effectiveness of the various rates were classified on the basis of reduction of stand as very poor (0, 5 lb.), poor (10 lb.), fair (25lb.), good (50 lb.) and excellent (100 lb.). Observations were made periodically during the summer of 1953 for degree of recovery. The 50 and 100 lb. rates kept the soil barren, while some recovery was noted in the plots treated with 25 lb. CMU. The other plots (5, 10 lb.) could not be distinguished from the check. The experiment will be kept for observations in 1953. (Contribution from the Division of Plant Science, The University of Manitoba).

Couchgrass eradication by tillage. Carder, A. C. This trial was designed to find a cultural method that would eliminate couch, Agropyron repens, in a period of one year. Eight procedures were tried: (1) one-way early June followed by one-waying every time 2 in. of green growth showed, (2) one-way early June followed by cultivator plus wireweeder, (3) one-way early June followed by spring-tooth harrowing, (4) skim-plow early June followed by one-waying, (5) shallow blade early June followed by one-waying, (6) fall one-way, one-way early June followed by one-waying, (7) fall plow, one-way early June followed by one-waying and (8) same as (7) except winter rye seeded in August. Other than treatment (8), which received only 8 cultivations, 10 cultivations were given in 1953, making 11 where treat-

ment was launched in the fall. Examination in mid-September, 10 months after the fall treatments were made, showed in order as listed above with the eighth procedure not scored, the following estimated percentages of couch growth remaining; 10, 10, 18, 10, 20, 5, 5, Two further cultivations were given after this date. Proper evaluation of the experiment must await 1954. Nevertheless, the importance of commencing tillage in the fall is emphasized by procedures (6) and (7). The principle of shredding the root stalks by a disc implement to induce starvation by growth seems as effective as dragging them to the surface for desiccation, as indicated by procedures (1) and (2). However, one-waying proved a much less troublesome method and in this experiment did not result in undue pulverization of the soil. Percipitation during the course of the experiment was above average. The soil is a shallow black clay loam. (Contribution of Experimental Station, Beaverlodge, Alberta.)

Treatment of couchgrass with CMU alone and in combination with cultural means. Carder, A. C. A continuous infestation of couch, Agropyron repens, on a shallow black clay loam was treated with CMU at nil, 10, 20, 40, and 80 lb/A. The chemical was sprayed (1) on undisturbed sod, (2) on undisturbed sod one-wayed 5 inches deep two weeks later (3) following one-waying 5 inches deep and (4) following one-waying 5 inches deep but preceding a second one-waying. The experiment comprised two treatment times: late spring and early fall. Examination one year from time of the fall treatment indicated the best kills to be effected by the spring application but equivalent kills may be obtained from the fall treatment when an equally long period of time has elapsed as up to the time of the last inspection the chemical had continued to reduce the couch on the spring-treated plots. Best kills were obtained by applying the chemical to undisturbed sod; in the case of the spring application these were 88, 96, 100 and 100 per cent effective for the 10, 20, 40 and 80 lb/A rates, respectively. Corresponding figures for the fall application are 88, 96, 98 and 100. (Contribution of Experimental Station, Beaverlodge, Alberta.)

The effect of different herbicides on couchgrass. Carder, A. C. In late spring when a vigorous sward of couchgrass, Agropyron repens, was a foot high and in shot-blade phenyldimethylurea (URAB) was applied at nil, 20, 40, 80 and 100 lb/A. in a water spray at the rate of 80 gal/A. The experiment involved application of CMU at 40 lb/A as a check. On a contiguous area and on the same date CIPC was applied at nil, 10, 20, 40 and 80 lb/A. In the autumn three months after treatment inspection indicated that there was no difference in degree of kill between URAB and CMU. URAB had induced kills of 65, 90, 98 and 99 per cent when applied at 20, 40, 80 and 100 lb/A, respectively. CIPC was much less effective producing kills of 5, 8, 12 and 49 per cent by the 10, 20, 40 and 80 lb/A rates, respectively. The final results of this trial will not be known until 1954. (Contribution of Experimental Station, Beaverlodge, Alb.)

The effect of dichloropropionic acid on couchgrass. Carder, A.C. Alpha, alpha, dichloropropionic acid (Dalapon) was applied to a vigorous sward of couchgrass, Agropyron repens, in late July. At this time the couch had been mowed once and the regrowth was 9 in. high. The chemical was applied at 10, 20, 40, and 60 lb/A in a water spray at the rate of 80 gal/A. Examination 2 months later indicated 95, 99, 100 and 100 per cent top-growth kill for the 10-, 20-, 40- and 60-lb dosages, respect-

ively. However, the root stalks indicated no decomposition at any rate but did appear an unhealthy yellowish colour. No resprouting was evident from the couch crowns or rhizomes except with the 10-lb. rate. The final results from this trial will not be known until 1954. (Contribution of Experimental Station, Beaverlodge, Alberta.)

Effectiveness of Dalapon and of TCA on clipped couch grass sod and on foliage with and without subsequent cultivation. W. G. Corns. Duplicate 100 square foot plots of dense roadside couch grass were used for each treatment of standing flowering vegetation or of the soil surface after clipping off the grass and raking the area bare. Chemical sprays were applied at 95 gal/A on June 26, 1953, and half of each plot was plowed five inches deep on July 15, three weeks later. Rates were:- Dalapon (a, a, dichloropropionic acid sodium salt) 1 & 2 oz. per 100 sq.ft. (17.59 and 35.18 lb. acid/A); TCA liquid: 96.7 and 193.4 lbs. sodium TCA per acre. At spraying time the ground was wet from previous rains. There was no more rain until four days after treatment, and the summer on the whole was wet. TCA caused the most rapid visual response at first, but all treated plots were browning at the time of plowing. Regrowth of couch grass was counted on September 3 and October 17, and the average number of shoots per 100 square feet was as follows: -

Treatment	Date	Material				
		None	Dalapon -lbs/A		TCA - lbs/A	
			17.59	35.18	96.7	193.4
Clipped and	Sept.3	40,000	53	24	12	0
sprayed	Oct.17		70	70	18	0
Clipped, sprayed	Sept.3	30,000	51	30	27	1
and plowed	Oct.17		78	65	22	0
Sprayed	Sept.3	----	18	14	123	0
	Oct.17		38	21	125	1
Sprayed and	Sept.3	----	33	15	45	1
plowed	Oct.17		31	40	49	1

At the end of the season there was still an abundance of apparently healthy, though dormant, rhizomes in all plots. Survival will be assessed next spring. The data appear to support the following generalizations: -

1. Removal of above-ground vegetation before chemical treatment was beneficial only with TCA rate 1. TCA rate 2 produced best of all results.
2. Foliage sprays of Dalpon were better than ground sprays of this chemical. Point of maximum effect of Dalapon appears nearly reached by Rate 1.
3. Post-treatment cultivation was of no advantage except with Rate 1 TCA on foliage. (Contributed by Department of Plant Science, University of Alberta).

The effect of herbicides or couch grass. Friesen, H. A. On July 26, 1953, TCA and CMU were each sprayed on plots of couch grass at the rates of 20, 40, 80 and 100 pounds of active ingredient per acre. Each of the TCA treatments resulted in a complete kill of the top growth in 1951. Regrowth in October of that year was noted only following two of the treatments. It was 5 and 1 percent of the original stand on those plots sprayed with 20 and 40 pounds of TCA, respectively. Each of the CMU treatments caused the couch grass to turn a sickly greenish yellow color but by freeze-

up in 1951 it did not appear to be completely dead.

In 1952, annual weeds such as stinkweed, Canada Fleabane and Russian pigweed heavily infested each of the TCA treated plots. Regrowth of couch on those plots treated with 20, 40, 80 and 100 pounds per acre of TCA was 80, 22, 5 and 3 percent, respectively. Regrowth on those plots treated with 20 and 40 pounds of CMU was 15 and 1 percent, respectively. The only growth noted on the plots treated with 80 and 100 pounds of CMU per acre were a few plants of prairie rose. However, these withered and died by August 15, 1952

In 1953 on those plots sprayed with 20, 40, 80 and 100 lb/A of TCA the regrowth of couch was 90, 65, 20 and 15 percent of the original stand, respectively. The annual weeds previously mentioned again infested the plots. In 1953 the effect of CMU, especially at the lower dosages, was beginning to weaken. The plots treated with 20 pounds of CMU showed 20 percent regrowth of couch grass. Futhermore, a light infestation of Russian thistle and Russian pigweed was observed. On the plots treated with 40 pounds of CMU the regrowth of couch amounted to only one percent of the original stand, a few to the flowering stage. On the plots which received 80 pounds of CMU per acre the only plants which were noted were prairie roses. While roses did not die they were not sufficiently healthy to produce flowers. The 100 pound per acre dosage prevented growth of any kind. Wheat planted on a portion of the plot in 1953 reached a height of two inches and then died. This trial was conducted on silty loam soil. (Contributed by the Dominion Experimental Station, Scott, Sask.) 1953

Effect of TCA, CMU and ester of para on quack grass (Agropyron repens), 1952-1953. Pavlychenko, T. K., Bestrop, A. J. In 1952 a series of plots 12 x 12 ft. in a solid sod on silty clay loam soil were top-sprayed at the heading stage with TCA in the form of ACP Grass Killer (TCA 90%) at rates of 25, 50, 75, 100 and 125 lb/A acid equivalent; CMU (3-p-chlorophenyl-1-1-dimethylurea) at 20 and 40 lb/A, and with ester of para in the form of ACP 903 at 10 and 20 lb/A rates. In one series the plots were undisturbed by cultivation. In the second series the sod was thoroughly cultivated. Treatments were then applied across the two series. Percipitation was scarce from late summer of 1952 to spring of 1953. RESULTS: 1952 results were presented in 1952 NCWCC Research Report. In the fall of 1953, the Tca treatments in the undisturbed series showed delayed but heavy regrowth in all plots except the 125 lb/A rate, where 12 pct. regrowth occurred. In the cultivated series, the regrowth amounted to 20 pct. in the 25 lb/A to only 1 pct. with 125 lb/A rates. CMU at the 20 lb/A rate was ineffective in the undisturbed series, where regrowth was general, although somewhat delayed. In the cultivated series, the surviving rhizomes produced topgrowth amounting to 8 pct. of the original population. The 40 lb/A rate of CMU was effective on both ranges, the plots being still devoid of any vegetation. ACP 903 was agronomically ineffective at both rates and in both series, allowing delayed but general regrowth. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

		UNDISTURBED SOD			CULTIVATED SOD		
		1952	1953		1952	1953	
Treatment	Rate lb/A	Topkill %	Regrowth %	Regrowth %	Topkill %	Regrowth %	Regrowth # %
TCA	25	95	5	90	100	5	20
TCA	50	100	5	80	100	2	10
TCA	75	100	5	75	100	1	5
TCA	100	100	5	45	100	0	1.5
TCA	125	100	1	12	100	0	1
CMU	20	30	20	100	100	50	8
CMU	40	75	25	0	100	35	0
ACP 903	10	12	0	100	100	15	100
ACP 903	20	20	0	95	100	10	100

All data are in pct. of the original population.
Note: TCA - sodium salt of TCA; CMU - (3-p-chlorophenyl-1-1-dimethylurea); ACP 903 - ester of para.

Response of quack grass (Agropyron repens) to TCA, 1950-1953. Pavlychenko, T. K., Bestrop, A. J. In old solid sod, a series of 8 x 12 ft. plots were established in 1950 and treated at the heading stage with 25, 50, 75, 100, 125 and 150 lb/A acid equivalent of TCA in a gallon of water per pound of the acid in the form of ACP Grass Killer (TCA 90%). The soil was a silty clay loam and moisture was reasonably good. RESULTS: The results for 1950 to 1952 were given in the 1952 NCWCC Research Report. The fall records of 1950 showed that 50 lb/A rates were agronomically ineffective, as numerous plants survived to reinfest the plots. Reinfestation increased in 1951 and 1952, and this year the quack grass is solid again. The 75 and 150 lb/A treatments were free of quack grass as late as 1952, in spite of a great abundance of quack grass seed on the ground. This indicates (a) that the original infestation was effectively destroyed and (b) that the annual weeds that invaded the plots have effectively competed with the seedlings, and also have prevented a re-invasion of quack grass from the untreated areas. In the fall of 1953 the same conditions hold true, except that the odd seedling began to get established to the extent of 5% of the original population in 75 lb/A and less than 1 pct. in 100 to 150 lb/A treatments. Under the conditions as stated above, all the treatments from 75 to 150 lb/A rates were agronomically effective. If left undisturbed the seedlings now observed will probably increase and in time will crowd out the annual weeds in the course of natural plant succession. (Contributed by Agr. Div. American Paint Company, Saskatoon, Sask.)

A comparison of Dalapon and TCA on quackgrass. Santelmann, P.W. and Willard, C. J. Dalapon at 5, 10, 20 and 40 pounds per acre and TCA at 20 and 40 pounds per acre, in three replications, were applied to a second-year alfalfa-red clover mixture which was heavily infested with quackgrass. A wetting agent, Dreft, was used at 0.1 of one percent of the spray. Treatments were begun one week after removal of the first cutting of hay. The plots were 10' x 75', divided into three parts (10' x 25' each), each part receiving a different cultural treatment. Section A was sprayed on June 6 and not treated further; B was sprayed on June 6 and plowed on June 15; Section C was plowed June 15 and

sprayed on June 20. Due to the extremely dry summer and fall in Ohio, the B and C treatments were inconclusive since there was little quackgrass recovery on the plowed checks. Better results perhaps could have been expected from the unplowed plots had there been more rainfall. As estimated October 13, the 5- and 10-pound rates did little damage to the unplowed quackgrass and alfalfa but killed about 50 percent of the red clover. Dalapon at 20 lb/A killed 75 percent of the quackgrass, 10 percent of the alfalfa and 80 percent of the red clover. TCA at 20 lb/A killed 10 percent of the quackgrass and alfalfa and 70 percent of the red clover. Dalapon at 40 lb/A killed 90 percent of quackgrass and red clover and 60 percent of alfalfa. TCA at 40 lb/A killed 40 percent of quackgrass and alfalfa and 80 percent of red clover. These estimates are preliminary; final data will be taken in 1954. (Contribution from the Ohio Agricultural Experiment Station.)

The effect of CMU on a variety of grass and weed species. Wood, H.E. Watson, W.D. Trials with 3-(p-chlorophenyl)-1, 1-dimethylurea, (CMU), in 1951 and 1952 were mainly with Quack Grass, Agropyron repens, but in 1953 an area was selected in Winnipeg infested with several weed species - Perennial Sow Thistle, Canada Thistle, Field Horsetail, Western Snowberry, Dandelion, the occasional other weed and some grass of various species. Square rod plots, replicated twice, were knapsack sprayed June 3, when the growth was quite rank and moderately dense, at the rate of 20,40 and 60 lbs. active ingredient in 80 imperial gallons water per A. Heavy rains had fallen previously, with ½ inch 5 hours after treatment. There was almost complete absence of all growth except for some of the deeper-rooted species - particularly horsetail and snowberry - during the balance of the season. Dense plots of quack grass treated in 1951 and 1952 with 40 lbs. per acre CMU and upward were still free of quack grass October 1, 1953. Canada Thistle had invaded plots treated with 20 and 30 lbs. Soil treated with CMU at 30 to 80 lbs. per acre has remained sterile to most plant growth for periods of from 1½ to 2½ years. (Contribution from the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada).

Control of Quackgrass with malcic hydrazide in combination with delayed cultivations. Zick, W.H. and Buchholtz, K.P. Quackgrass with a top growth of from 4 to 6 inches was treated on May 2, 1952 with 0, 4,8, and 16 lbs/A of MH as the sodium salt applied in water equal to 40 gals/A. A rototiller was used to cultivate series of plots on the 10th and 26th day following MH applications. Rototilling completely pulverized and mixed the top 3 in. of soil. The effectiveness of treatments was measured by shoot counts taken on June 24, 1952 and May 9, 1953 and by dry weights of rhizomes separated from plugs dug in late August, 1952. The June 24 data show a significant reduction in shoot count on plots given the 16 lb/A application for all periods of cultivation delay, while the 4 and 8 lb/A applications gave significant reductions only in combination with 3 and 10 day delays. The May 8, 1953 data show significant reductions in shoot count by all rates of MH, but only when in combination with 3 and 10 day delays of cultivation. These results indicate that most of the inhibitory effect of the MH was overcome by 26 days after spray application. The recovery of the quackgrass from June, 1952 to May, 1953 was slight as measured by the shoot count data. A dense growth of annual weeds developed shortly after the cultivation treatments and gave a smothr crop effect. No doubt part of the control indicated

by the May, 1953 shoot counts was due to this smother crop effect. The rhizome weight data show a significant reduction in live rhizome material given by the 8 and 16 lb/A applications, but only when in combination with cultivations at 3 and 10 delays. The 4 lb/A application also gave a significant reduction in rhizome weights when in combination with cultivation delayed 10 days. (Dept. of Agron., Univ. of Wis., Madison, Wisconsin.)

JOHNSON GRASS AND BERMUDA GRASS

Summary W. C. Elder

Seven abstracts were received on control of Johnson grass. The principal chemicals used in tests were CMU, TCA, sodium chlorate and Dalapon. One state was interested in cultivation methods of control, also combining cultivation and chemicals.

20 to 40 lb./A CMU killed Johnson grass on sandy soils. 20 lb./A CMU applied in June, 1952 prevented germination of corn planted in May, 1953. 40 lb./A TCA applied 2 months before planting corn did not affect the crop. Plowing Johnson grass at the proper time, and combined with chemicals looks promising.

Dalapon at rates from 20 to 80 lb./A gives quick top kill of Johnson grass, but there is some question as to how much root kill is obtained from these preliminary tests. Up to 20 lb./A Dalapon and 40 lb./A TCA applied on Johnson grass infested land after first cutting reduced alfalfa yield only slightly and gave good control of the grass.

Abstracts of Results of Cooperators

Late spring preparation of land for control of Johnson grass. Burt, E. O. and Willard, C. J. The purpose of this experiment was to control established Johnson grass by applying sodium TCA in the early spring. The field was in pasture in 1951 and until mid-August of 1952, when it was plowed. Sodium TCA was applied March 7, March 21, and April 4 at rates of 0, 10, 20, and 40 lb/A. acid equivalent. Quadruplicate plots, 4 corn rows wide and 50 feet long, were used for each date and rate of treatment. Seedbed was prepared May 17 but, due to rain, corn was not planted until the seedbed was prepared a second time on May 25. There was too little Johnson grass in the check plots to provide evaluation of the chemical treatments. The thin stand of Johnson grass on the checks may be attributed to two factors: (a) the moderately early plowing following pasturing in the previous year; (b) the two seedbed preparations on May 17 and May 25. Since much of the field was planted with only one preparation, there was large-scale evidence of the effect of the second preparation. Corn was not visibly damaged by any rate of TCA applied on any of the three dates, so that had the chemical treatment been necessary, it would have been safe to use on this river bottom loam soil. (Contribution of Ohio Agricultural Experiment Station.)

Sodium TCA, sodium chlorate and cultural practices for the control of Johnson grass. Burt, E. O. and Willard, C. J. Experiments were conducted near Chillicothe, Ohio, on river bottom sandy loam soil. Field was in corn in 1950 and in lightly grazed Johnson grass pasture 1951 and 1952. Triplicated plots 27 by 50 feet, split-plot design. Four strips were plowed respectively on July 30, August 20, and September 10, 1952, and on March 21, 1953. Corn was planted May 19, 1953. Estimate of percent control of top growth from rhizomes was made June 20. Plowing July 30 with one disking a month later resulted in 84% control of top growth from rhizomes compared to the September 10 plowing. Plowing August 20 gave 50% control of top growth. Plowing March 31, 1953 gave 12% better control than the September 10 plowing. The yields per acre of corn otherwise untreated were: Plowed July 30, 69 bu.; August 20, 49 bu.; September 10, 31 bu.; and March 21, 28 bu. Sodium TCA at rates of 0, 20 and 40 lb/A, acid equivalent, and sodium chlorate at rates of 0, 100, and 200 lb/A, commercial material, were

applied across the different plowed strips on September 15 and October 15, 1952. About 15% better control was obtained when the herbicides were applied on the earlier date. Herbicides applied September 15 on land plowed July 30 gave from 93 to 99 percent control of top growth from rhizomes. Poorer results were obtained when the land was plowed later. Chlorate was from 10% in the July plowing to 80% in the September and March plowings more effective than TCA at the rates used. Chlorate at rates of 100 and 200 lb/A gave 77 and 90% control of top growth when applied September 15 on land plowed September 10; TCA at rates of 20 and 40 lb/A similarly applied was ineffective. Corn in plots treated with chlorate matured about 2 weeks earlier than corn in the other plots, with severely reduced yields. Moisture determinations at time of harvest showed that corn in plots treated at 0, 100, and 200 lb/A contained 30.4, 28.7, and 25.0% moisture, respectively. The moisture content of corn was not affected in plots treated with TCA. (Contribution of the Ohio Agricultural Experiment Station.)

Dalapon for control of Johnson grass in established alfalfa. Burt, E. O. and Willard, C. J. Applications of Dalapon and sodium TCA to an alfalfa-Johnson grass mixture were made at two locations on two dates, immediately after removal of the first and second cuttings. A randomized block design with plots 14 by 40 feet replicated three times was used. Based on hand separation of the mixtures, the percent of alfalfa on July 13 on plots treated June 3 was 60, 76, 82, 92, 100 and 100 at rates of 0, 2 1/2, 5, 10, 20, and 40 pounds, acid equivalent, per acre of Dalapon, respectively. The percent of alfalfa was 60, 82, 96 and 100, following applications of 5, 10, 20, and 40 pounds, acid equivalent, of TCA. Forage was again harvested August 17 and the percent of alfalfa in the mixture was 47, 47, 50, 63, 93, and 94 for the respective rates of Dalapon and 47, 52, 68, and 92 for TCA. Alfalfa yields were reduced slightly in plots treated at the rate of 20 lb/A of Dalapon and 40 lb/A of TCA, and more than 50% in plots treated at the rate of 40 lb/A of Dalapon. Similar results were obtained when applications were made following the removal of the second cuttings. Similar but somewhat better results were obtained at the other location. (Contribution of the Ohio Agricultural Experiment Station.)

Chemical control of Johnson grass and Bermuda grass. Dreessen, Jack and Elder, W. C. The chemicals used in these tests were TCA, a,a,dichloropropionic acid (Dalapon), 3-p-chlorophenyl-1;1-dimethylurea (CMU), 3-(3,4-dichlorophenyl)-1, 1-dimethylurea, and 1-(3,4-dichlorophenyl)-1, 1-dimethylurea. Rates of application ranged from 20 to 100 lb/A in 80 gallons water per/A. Square rod plots of established stands of Bermuda grass on clay soil and Johnson grass on sandy soil were treated at monthly intervals during the growing season of 1953. Readings were made in November for all plots. 50 and 100 lb/A of TCA were ineffective on Johnson grass when applied in June and July. 50 lb/A of TCA applied in August killed 95-100% of the grass. Ineffective control in June and July may be due to heavy rains that occurred in July and August. 20 lb/A CMU killed most of the Johnson grass in all months, but 40 lb/A was necessary to obtain absolute control for eradication of the grass. 3-(3,4-dichlorophenyl)-1,1-dimethylurea when applied at the same rates as CMU appears to be slightly less effective and plants reacted slower to treatment. 1-(3,4-dichlorophenyl)-1,1-dimethylurea was inferior to CMU when applied on Johnson grass at equivalent rates; 60 lb/A gave less than 50% control of the grass. Dalapon at 50 to 100 lb/A killed the tops of Johnson grass and Bermuda grass soon after application; however, applications made in July and August had many live rhizomes and some regrowth appearing in November. In these tests Bermuda grass was more difficult to control with all chemicals than Johnson grass; however, in previous experiments TCA was more effective on Bermuda grass than on Johnson grass. The difference in soil texture and the heavy mat of

Bermuda grass on the surface of the soil may account for differences observed in these tests. (Contribution of Agronomy Department, Oklahoma Agricultural Experiment Station.)

Control of Johnson grass with dalapon and TCA. Freeman, J. F. -Dichloropropionic acid (Dalapon) sodium salt at 0, 20, 40 and 80 lb/A and TCA sodium salt 100 lb/A were applied in water, 240 gal/A as foliage sprays on Johnson grass of one set of plots July 14, 1953 when seeds were in early milk stage and to a second set August 18 when regrowth of plants mowed July 14 had reached height of 2 to 3 feet. Soil sprays of Dalapon at above rates and TCA at 80 lb/A were applied July 14 on a third set of plots from which Johnson grass had been removed as hay and the land plowed and disked just prior to treatment. "Tide" 1 lb/100 gal water was used as wetting agent. Rains amounting to 3 inches fell between July 17 and August 5 and 1.13 inches between September 5 and October 20. Preliminary observations of October 20 follow: Foliage sprays on first growth Johnson grass, Dalapon 0, 20, 40 and 80 lb. and TCA, 100 lb/A killed leaves and stems of 0, 90 95, 100, and 100% of plants respectively. Weights of live rhizomes and roots remaining in the soil of square foot quadrats were 290, 190, 205, 55 and 90 gm. Foliage sprays at like rates on second growth Johnson grass killed the top growth of 0, 80, 90, 95 and 93% of plants respectively and the weights of live rhizomes were 200, 80, 135, 40 and 50 gm/sq.ft. Soil sprays of Dalapon 0, 20, 40 and 80 lbs and TCA 80 lb/A resulted in 40, 4, 2.5, 0.2, 0.3 plants/sq. yd. and live rhizome weights of 180, 25, 27, 12 and 4 gm/sq.ft. (Kentucky Agricultural Experiment Station.)

Preliminary observations of Dalapon on Johnson grass. Fletchall, O. Hale. When sodium salt of a,a-dichloropropionic acid (Dalapon) was applied at a 20 pound per acre rate to second growth Johnson grass, July 23rd, 1953, a complete kill of top growth resulted in five weeks. An application of 50 pounds per acre merely reduced the time for killing by about one week. The top growth of a stand of Johnson grass four feet tall and in the flowering stage was killed by a 40 pound per acre treatment of Dalapon and very little viable seed was formed. (Contribution of the Missouri Agricultural Experiment Station.)

CMU for Johnson grass control. Lee, Oliver C. Rates of CMU of 20, 40, 60, 80, 100 lb/A were applied on replicated plots to Johnson grass (Sorghum halepense) on June 19, 1952. 160 gal/A of water was used. Grass was mowed to a height of 6 in. before chemicals were applied. Soil is a sandy loam. All rates destroyed top growth and prevented new growth throughout the remainder of the season. Excavations made on October 20 indicate that all rates of CMU used have destroyed the rootstocks. Rootstocks were found to a depth of 14 in. in check plots. The plot area was plowed during April of 1953. Corn was planted on May 22. All rates of CMU prevented the emergence of corn and Johnson grass during the 1953 growing season. (Department of Botany and Plant Pathology, Purdue University, Lafayette, Indiana.)

CANADA THISTLE AND PERENNIAL SOW THISTLE

C. J. Willard

Summary

Eight abstracts on Canada and perennial sow thistles were received from 3 stations. In general they agreed with previous reports and with each other in these points:

1. No single application of any hormone chemical gives a complete kill of these thistles at any rate.

2. Heavy doses kill the tops more quickly, but do not kill the roots as deep, as lighter (not the lightest) doses.

3. MCP and 2,4,5-T are both inferior to 2,4-D on these thistles.

4. Eradication of these weeds by hormone treatments alone requires at least two years, and usually longer.

5. Combinations of cultural treatments with 2,4-D are promising. A combination of 2,4-D (twice) followed by deep plowing late eradicated Canada thistles in two years in one test.

6. Canada thistle is comparatively tolerant to CMU, though large (40 lb/A or above) doses can kill it. Combinations of soil sterilants may be effective.

Abstracts

Field observations on the control of Canada thistle (Cirsium arvense). Heggeness, H. G. and J. H. Miller. Four tests on natural infestations, utilizing (1) 2,4-D acids, amines, regular and low-volatile esters (2) MCP amine and esters (3) mixtures of 2,4-D and 2,4,5-T acids (4) 4-chlorophenoxyacetic acid, and (5) other miscellaneous preparations, have shown that none of these is particularly outstanding for controlling this weed under Minnesota conditions. The 2,4-D preparations were generally more effective than the others, however. This applies to single foliage applications of the herbicide, i.e. once a year, at rates varying from 1 lb to 8 lb per acre in 30 gallons of solution. Using counts of surviving stems or numbers of new aerial shoots formed as an index of control, the best chemicals caused a reduction in stand of from twenty to sixty percent. When the same applications were made the second year (to the same plots) the percentage reduction varied from sixty to ninety percent. It was observed that spring or fall plowing followed by one herbicidal treatment (six weeks later) caused a reduction in stand of ninety percent, or more. This procedure was considered very effective. These trials were frequently characterized by the lack of uniformity of results between replications of all herbicides tested. It was determined that this is partly due to variations in root structure between individual plants. In well drained locations the propagating buds were mostly located on vertical rootstocks. These rootstocks, with their buds, were usually killed to a depth of 5 or 6 inches with most herbicides. In other plants, especially in poorly drained areas, the subteranean buds were found on horizontal roots (which had developed laterally from the main rootstock). These buds were seldom killed by herbicides. Spraying actually increased the numbers of thistle stems in these situations, for several buds would sprout after the death of one main, aerial, stem. Thistles from many locations have been cultured in the greenhouse. These show morphological and physiological differences which appear to be related to 2,4-D response under laboratory conditions. (Contribution of Minn. Agric. Exp. Station, Dept. of Plant Path. and Agric. Botany; and USDA, BPIS and AE., Div. of Weed Investigations.) (Scientific Paper No. 3084, Minnesota Agricultural Experiment Station.)

Cultural methods alone and supplemented by herbicides for control of Canada thistle (Cirsium arvense). Miller, J. H. and R. S. Dunham. Each of the following treatments was carried out in 1952 and repeated on the same plot in 1953. Three of the treatments involved the use of oats with "follow-up" treatments. They were: (1) Oats - spray the oat crop with 3/4 lb 2,4-D acid (low volatile ester) - spray oat stubble with 2 lb 2,4-D acid (low volatile ester) - plow deep in late October (Canada thistle about 4-6 inches tall when sprayed in oats); (2) Oats - plow immediately after harvest - spray emerged thistles with 2 lb 2,4-D acid (low volatile ester) - resume cultivation 1 month later; (3) Oats - plow immediately after harvest and follow with cultivation. Of these, treatment 1 was outstanding in that Canada thistle was eliminated whereas heavy stands still remain for treatments 2 and 3. A second study compared continuous fallow to fallow in which spraying with 2 lb 2,4-D acid (low volatile ester) was substituted for one of the cultivations. Both treatments were effective in reducing Canada thistles to a large degree but the treatment involving 2,4-D was superior to continuous fallow. A third portion of the study involved the use of late sown competitive crops. Sudan grass and proso millet were sown July 1 following intensive cultivation. The crops were harvested Sept. 15 (Sudan grass for hay, proso millet for grain) and the area was plowed immediately. These treatments resulted in considerable reduction of Canada thistle but were not equal to oats with spray applications of 2,4-D, or to fallow with 1 spray application of 2,4-D. (Contribution of USDA, BPIS&AE, Division of Weed Investigations; and Minn. Agric. Expt. Station, Dept. of Agronomy and Plant Genetics.) (Paper No. 3075, Sci. Jour. Series, Minnesota Agricultural Experiment Station.)

Repeated treatments with herbicides to control Canada thistle (Cirsium arvense). Miller, J. H. and H. G. Heggeness. A natural infestation of Canada thistle was sprayed for 2 years with a dimethylamine salt of 2,4-D. Four rates of application (1/8, 3/8, 1 and 2 lb acid in 30 gallons of water per treatment) were made at 15 day intervals beginning July 1 (6 weeks after plowing). The experiment was designed for both single and multiple applications at the 4 rates. Plot 1 was sprayed once on July 1, Plot 2 was split - $\frac{1}{2}$ was treated once on July 15, and $\frac{1}{2}$ was treated on July 1 and July 15. Plot 3 - $\frac{1}{2}$ sprayed once on August 1, while the other half was sprayed three times, July 1, July 15, and August 1. Plot 4 - $\frac{1}{2}$ sprayed on August 15, while the other half received 4 applications. Plot 5 - $\frac{1}{2}$ sprayed on September 1, while the remainder received 5 applications. Plot 6 - $\frac{1}{2}$ sprayed once on September 15, while the remainder received 6 applications. Thus, in the 1 lb rate series $\frac{1}{2}$ of plot 6 received a total of 1 lb whereas the other half received 6 lb in 6 applications. Treatment at the 1 and 2 lb rates on July 1 and July 15 resulted in 90 to 95% kill and were vastly superior to applications at later dates. Additional applications after July 15 up to a maximum of 6 applications did not materially increase the kill. The kill from repeated applications of 1/8 and 3/8 lb did not equal that of a single application of 1 lb July 1 or July 15, but was superior to single applications of 1 or 2 lb in September. Six applications of 3/8 lb or a total of $2\frac{1}{4}$ lb did not result in satisfactory kill of Canada thistle. The Canada thistle plants were in the "shooting" to very early bud stage of growth at the effective spraying dates, July 1 and July 15. (Contribution of USDA, BPIS&AE, Division of Weed Investigations; and Minn. Agric. Expt. Station, Dept. of Plant Path. and Agric. Botany.) (Scientific Paper No. 3085, Minnesota Agricultural Experiment Station.)

Effect of systemic herbicides on Canada thistle (Cirsium arvense), 1953. Pavlychenko, T. K., and Bestrop, A. J. Square rod plots on stubble land were treated in the pre-bud to bud stage with 1 and 2 lb/A rates of butoxy ethanol ester of 2,4-D at 40 pct. concentration (Weedone LV4) and Weedone LV4 reduced to 9.6 pect. concentration, ethyl ester of 2,4-D at 40 pct. concentration (Weedone Concentrate) and Weedone Concentrate reduced to 9.6 pct. concentration, amine salts of 2,4-D (ACP 127 and Weedar 80), amine salt of MCP (Weedar MCP) and mixture of esters of 2,4-D and 2,4,5-T (Brush Killer 32). RESULTS: 58 days after treatment, the topkill was from 70 pct. with Weedar 80, 1 lb/A to 100 pct. with Weedone LV4 Dilute, 2 lb/A. The plants which were not fully killed at this time were badly discolored, twisted and dying. Translocation into the vertical and lateral roots was more extensive with butoxy ethanol and ethyl esters than with other chemicals used. Regrowth was present in every treatment, mostly coming from the lateral root buds located beyond the zones of translocation. Depending on the abundance of lateral roots escaping effects of the chemicals due to the limited translocation, the regrowth varied from 4 pct. of original population with Brush Killer 32, 2 lb/A, to 60 pct. with Weedone LV4 Dilute, 2 lb/A. Final notes on regrowth will be taken in 1954. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Effect of systemic herbicides on Canada thistle (Cirsium arvense), in pre-bud stage, 1952-1953. Pavlychenko, T. K., and Bestrop, A. J. Square rod plots, growing on low land (clay loam soil) were treated with 1½ and 3 lb/A rates of ethyl ester of 2,4-D at 40 pct. concentration (Weedone Concentrate) and Weedone Concentrate reduced to 9.6 pct. concentration, butoxy ethanol ester of 2,4-D at 40 pct. concentration (Weedone LV4) and Weedone LV4 reduced to 9.6 pct. concentration, another butoxy ethanol ester of 2,4-D (ACP 129), amine salts of 2,4-D (Weedar 80 and ACP 127), amine salt of MCP (Weedar MCP), pentasyl ester of 2,4-D (ACP 649), mixture of esters of 2,4-D and 2,4,5-T (Brush Killer 32), ester of para (ACP 903) and mixtures of acids of 2,4-D and 2,4,5-T (ACP 926). RESULTS: The 1952 results were listed in the NCWCC Research Report for 1952. In September, 1952 the topkill was very high in all treatments excepting in ACP 903 and Weedar MCP plots. The same relative situation existed in July, 1953. The translocation into the roots, however, had progressed further, as evidenced by considerable reduction in the regrowth that was recorded in 1952. The regrowth recorded in 1953 expressed in percent of original population, was as follows: Weedone Concentrate, Weedone Concentrate Dilute, Weedone LV4, Weedone LV4 Dilute and ACP 129, 5 pct. or less; ACP 649, Weedar 80, ACP 127, ACP 926 and Brush Killer 32, 10 to 15 pct; Weedar MCP and ACP 903, 15 to 20 pct. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Effect of systemic herbicides on perennial sow thistle (Sonchus arvensis). 1953. Pavlychenko, T. K., and Bestrop, A. J. Square rod plots growing on stubble land (loam soil) were treated in the early pre-bud stage with 1 and 2 lb/A rates of butoxy ethanol ester of 2,4-D at 40 pct. concentration (Weedone LV4) and Weedone LV4 reduced to 9.6 pct. concentration, ethyl esters of 2,4-D at 40 pct. concentration (Weedone Concentrate) and Weedone Concentrate reduced to 9.6 pct. concentration, amine salts of 2,4-D (ACP 127 and Weedar 80), amine salt of MCP (Weedar MCP) and mixture of esters of 2,4-D and 2,4,5-T (Brush Killer 32). RESULTS: All treatments, with the two esters at both rates, gave 100 pct. topkill. The 1 lb/A rates of ACP 127, Weedar 80, Brush Killer 32, and both rates of Weedar MCP gave agronomically significant weed control, but the kill of top growth was incomplete. The butoxy ethanol esters also showed somewhat better translocation through the vertical and lateral roots, closely followed by the other esters used. In many cases the vertical roots were dead to the depth of 6 inches and the laterals dead or dying 5 to 11 inches away from the treated shoot. The remaining

chemicals translocated slower and to shorter distances. Some regrowth occurred in all treatments. By tracing the roots of the new shoots it was established that a great majority of them were originating from the buds located beyond the zone of translocation or from the roots having no top shoots at the time of treatment; in other words, from roots which escaped contact with the chemicals. The amount of regrowth varied from 5 to 47 pct., depending mostly on the density of underground runners. Final records will be taken in 1954. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Effect of systemic herbicides on perennial sow thistle (Sonchus arvensis) in pre-bud stage, 1952-1953. Pavlychenko, T. K., and Bestrop, A. J. Square rod plots on low land clay loam were treated in the early pre-bud stage with 1 and 2 lb/A rates of ethyl ester of 2,4-D at 40 pct. concentration (Weedone Concentrate) and Weedone Concentrate reduced to 9.6 pct. concentration, butoxy ethanol ester of 2,4-D at 40 pct. concentration (Weedone LV4) and Weedone LV4 reduced to 9.6 pct. concentration, another butoxy ethanol ester of 2,4-D marked ACP 129, amine salts of 2,4-D (Weedar 80 and ACP 127), amine salt of MCP (Weedar MCP), pentasyl ester of 2,4-D (ACP 649), mixture of esters of 2,4-D and 2,4,5-T (Weedone Brush Killer 32), mixture of 2,4-D and 2,4,5-T acids (ACP 926) and ester of para (ACP 903). Weed counts in square yard plots permanently marked were made previous to treatments to provide the basis for expressing the percentages of the kill and regrowth in terms of the original infestation. RESULTS: The 1952 results were listed in the 1952 NCWCC Research Report. In September, 1953 the regrowth from roots was from 0 to 2 pct. with the ester and amine formulations of 2,4-D. The butoxy ethanol ester formulations were even more uniformly effective in their action. The remaining chemicals produced regrowth from 1 to 5 pct. and were slightly less effective. The stand of native grass in the treated plots has improved immensely and may be vigorous enough to prevent a reinfestation by seedlings. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.).

Herbicides used at 1 and 2 lb/A	Shoots, Sept. 1952			Regrowth, Sept. 1953					
				Seedlings sq.yd.		Shoots sq.yd.		Pct. shoots orig. pop.	
	Orig. pop. plants sq.yd.	Pct. orig. pop. 1 lb	2 lb.	1 lb	2 lb	1 lb	2 lb	1 lb	2 lb
WC*	107	1	1	2	2	0	0	0	0
WC Dil	110	0	9	8	12	2	0	2	0
LV4	88	1	0	18	0	0	0	0	0
LV4 Dil	91	2	4	6	7	0	1	0	0
ACP 129	117	0	0	0	3	0	0	0	0
Weedar 80	101	1	8	5	4	1	0	1	0
ACP 127	89	1	0	3	2	0	0	0	0
Weedar MCP	90	3	1	4	2	3	2	3	1
ACP 649	83	0	2	2	2	0	1	0	1
BK 32	84	0	1	10	9	4	1	5	1
ACP 926	149	1	1	12	5	2	2	1	1
ACP 903	85	3	3	15	17	1	3	1	4

*WC - ethyl ester of 2,4-D; WC Dil - WC reduced to 9.6 pct.; LV4 - butoxy ethanol ester of 2,4-D; LV4 Dil - LV4 reduced to 9.6 pct.; ACP 129 - another butoxy ethanol ester of 2,4-D; Weedar 80 and ACP 127 - amine salts of 2,4-D; Weedar MCP - amine salt of MCP; ACP 649 - Pentasyl ester of 2,4-D; BK 32 - mixture of esters of 2,4-D and 2,4,5-T; ACP 926 - mixture of acids of 2,4-D and 2,4,5-T; ACP 903 - ester of para. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.).

Various herbicides and combinations used to control Canada thistle growing in competition with grasses. Wood, H. E., Buskirk, G. C., Watson, W. D., Fox, W. B., Fraser, D. D. In Winnipeg various herbicides and combinations were used to control Canada thistle, Cirsium arvense, competing with grasses of mixed species. May 20, 1953, sq. rod plots in which thistles were commencing to emerge were knapsack sprayed at rates of 20 lb CMU plus 400 and 800 lb Polybor Chlorate, active ingredients, per A, in 160 imperial gal. water. Similar applications were made June 22, to nearby plots when the thistle were in pre-bud. Observations throughout the season indicated: complete eradication of all grasses; considerable survival of thistle, especially on early treated plots; best control with heavier applications at later date. On July 21, when Canada thistle was in full bloom, CMU 10 lb per A active was used in combination with 400 lb and 800 lb Polybor Chlorate (also one plot 20 lb CMU plus 800 lb Polybor Chlorate), 10 lb CMU plus 40, 80 and 160 lb Ammate. Nearly complete control of thistle was obtained on all plots. Only on the 40 lb Ammate plot did considerable grass remain. Beside these plots MCP ester and 2,4-D butyl ester at 1½ lb acid equivalent in 160 gal water per A were compared. Also nearby June 29, MCP sodium salt at ½ and 1 lb MCP ester at 1 lb and 2,4-D at 1 lb in 160 gal water per A were applied when thistles were in the advanced bud stage. MCP sodium salt at 1 lb was superior to MCP ester but hardly equal to 2,4-D at similar rates. (Contribution from the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada.)

FIELD BINDWEED

Summary — J. W. Zahnley

Only three reports of experiments on the control of bindweed were received for this summary. Two of these deal with the same three soil sterilants; namely Sodium chlorate, CMU, and the Boron compounds. The applications at these two locations were made in 1952. Probably, therefore, by autumn of 1953, ample time has elapsed to determine the relative effectiveness of these treatments. Bindweed was eliminated at the Amarillo Experiment Station by as low as 40 lb CMU, 800 lb sodium chlorate, and 3200 lb of concentrated borascu per acre applied in February. Complete kills were not obtained by applications made in July or October even at considerably higher rates. At Hays, Kansas, bindweed was not eliminated by any of the chemicals used, however, 960 lb sodium chlorate per acre seemed to be more effective than 80 lb CMU or 2560 lb concentrated borascu.

The low volatile butoxy ethanol and propylene glycol esters of 2,4-D were no more effective than the high volatile ethyl ester in the tests at Manhattan, Kansas. On the average, 0.5 lb per acre seemed to be as effective as higher rates of these 2,4-D formulations. MCP, diethanol amine salt, was less effective than the 2,4-D esters. Chlorinated Benzoic Acid at 3 and 6 lb per square rod was least effective of all herbicides used in this test. Polyborchlorate at 10 lb per square rod was the most effective. Nothing was gained by repeated applications of light rates at short intervals compared with a single application of an equivalent total amount.

Abstracts of Results of Cooperators

THE use of soil sterilizing chemicals for field bindweed control. Phillips, W. M. Sodium chlorate, CMU, several boron compounds, and two borate-sodium chlorate mixtures were applied to field bindweed plots on May 20, 1952. At the time of application the surface soil was moist but, following application, no rainfall of any consequence was received for a considerable period. Until May 16, 1953, not more than 1 in of rain fell in any one 24 hour period and it was not until July 9 to 12, 1953, that sufficient rainfall occurred to be effective in leaching chemicals into the subsoil. Plant counts taken in September, 1953 showed that 960 lb of sodium chlorate /A had reduced the stand of bindweed 95%. Six hundred forty lb of sodium chlorate /A was slightly less effective but was more effective than any other chemical except 120 lb/A of CMU and 3200 lb/A of concentrated borascu. Eighty lb of CMU/A gave about 70% reduction compared with 95% reduction of 960 lb/A of sodium chlorate. Concentrated borascu at 2560 lb/A gave a 60% reduction in stand with 3200 lb of this material being nearly equal to 960 lb/A of sodium chlorate. The soluble borates and chlorate-borate mixtures were ineffective except at rates of 1600 lb/A but at this level they were approximately equal to 80 lb of CMU/A. A similar experiment was started in 1953 with the applications made May 6. Preliminary results indicate that sodium chlorate has been less effective than in 1952 and, with the exception of the higher rates of CMU (80 and 120 lb/A) and 80 lb/A of Phenyldimethylurea, other chemicals have not been effective in controlling the field bindweed. (Contribution by Division of Weed Investigations, BPISAE, USDA, and the Kansas Agricultural Experiment Station, Fort Hays Branch, Hays, Kansas.)

RATES and formulation study of herbicides on field bindweed (Convolvubus arvensis). Szabo, Steve S. and Zahnley, J. W. Three series of sq rod plots of bindweed were treated at the late bud to early bloom stage, June 21-24, 1953, with 2,4-D, MCP, Chlorinated Benzoic Acid, and Polyborchlorate. The 2,4-D and MCP formulations were applied at 0.5, 1, 1.5 and 1.5 (in three applications of 0.5 lb each on consecutive days) lb/A rates. The following results were obtained: the high volatile ethyl ester of 2,4-D gave 54%, 29%, 40%, and 48% control, respectively; the low volatile butoxy ethanol ester of 2,4-D gave 25%, 48%, 24%, and 36% control, respectively; the low volatile isooctyl ester of 2,4-D gave 38%, 43%, 24%, and 34% control, respectively; the dimethylamine salt of 2,4-D gave 27%, 23%, 29%, and 37% control, respectively; the diethanolamine salt of MCP gave 36%, 16%, 15%, and 27% control, respectively; chlorinated Benzoic Acid at rates of 3,6 and 6 (three 2 lb applications on consecutive days) lb/A treatments gave less than 25% control in all cases. Polyborchlorate at rates of 6, 8, 10, and 8 (four 2 lb applications on consecutive days) lb/sq rod, yeilded 27%, 51%, 63%, and 56% control, respectively. The percentage control was based on the percent of Fall regrowth as compared to that of the check plots. The effectiveness of the herbicies was reduced by unusually dry weather and periods of extremely high temperature. (Contribution of the Kansas Agricultural Experiment Station).

CONCENTRATED borascu, sodium chlorate, and CMU for control of field bindweed (Convolvulus arvensis). Wiese, A. F. and Rea, H. E. Concentrated borascu at 14, 16 and 18 lb/sq rod, sodium chlorate at 3, 5 and 7 lb/sq rod, and CMU at 40, 60 and 80 lb/A were applied in February, July and October, 1952, to plots varying in size from 1 to 4 sq rods. All rates of all chemicals except the 3 lb rate of sodium chlorate applied in February eliminated the bindweed. None of the chemicals applied in July or August completely controlled the weeds, although all rates of CMU reduced the stand about 98%. Concentrated borascu at 14, 16 and 18 lb/sq rod on the last two dates gave about 90% control. Control with 3, 5 and 7 lb of sodium chlorate applied in July was 80%, 80% and 90%, respectively, and in the October application was 86%, 92% and 98%, indicating that the chlorates applied in July were not as effective as those applied in October. The rainfall from April, July and October, 1952 to October, 1953 was approximately 23, 17 and 11 in, respectively. (Contribution from the Amarillo Experiment Station, USDA and Texas Agricultural Experiment Station Cooperating).

Hoary cress and Russian knapweed

Summary — Neal E. Shafer

Five abstracts were received, three reported work on hoary cress and two reported on Russian knapweed. Pavlychenko reported results with several formulations and concentrations of 2,4-D on Russian knapweed as foliage applications. Reductions in stand ranged from 57% down to 18%. Shafer and Sand using several soil sterilants on Russian knapweed obtained kills ranging from 72% to 100%. A mixture of 20 lb CMU and 20 lb 2,4-D gave 97% kill.

Two abstracts on hoary cress reported good kills with 2,4-D at rates from 2 lb to 30 lb/A and with CMU at 40 lb and 80 lb/A. The third reported only fair results in 1953. Unusually high temperatures and dry conditions were given as possible reasons for reduced effectiveness.

Abstracts of Contributors

Russian knapweed

Effect of systemic herbicides on Russian knapweed, (Centaurea repens), 1952 - 1953. Pavlychenko, T. K., Bestrop, A. J. Replicated sq rod plots growing in brome grass sod, were treated in 1952 in the early flower stage with 2 and 4 lb/A rates of ethyl esters of 2,4-D (Weedone Concentrate) and butoxy ethanol esters of 2,4-D (Weedone LV4) both at 40 and 9.6 per cent concentrations, pentasyl ester of 2,4-D (ACP 649), mixture of acids of 2,4-D and 2,4,5-T (ACP 926), mixture of esters of 2,4-D and 2,4,5-T (Brush Killer 32), amine salt of 2,4-D (Weedar 80) and ester of MCP (ACP 904). Results: Preliminary results were reported in the 1952 NCWCC Research Report. All treatments gave good top kill. The depth of root kill varied from 3 in. with more effective chemicals such as Weedone LV4, to only 1 in. with the less effective ones like ACP 904. Regrowth from roots was observed in all treatments in the fall of 1952, varying from 3 to 30 per cent of the original population. In the fall of 1953, the chemicals could be placed in two main groups. Weedone LV4 Dilute, Weedone LV4, Weedone Concentrate Dilute and Weedone Concentrate, the chemicals which caused the most root kill in 1952, now have regrowths ranging from 43 to 47 per cent. The remaining group of chemicals, which showed less root kill in 1952, now have regrowths ranging from 54 to 82 per cent. (Contributed by Agricultural Division, American Chemical Paint Company, Saskatoon, Saskatchewan.)

Data

Treatment	Rate lb/A	Orig. pop. plots sq/yd	Topkill %	Depth of root kill in.	Regrowth from roots % 1952	Regrowth from roots % 1953
W.C.	2-4	19	90-86	2	9-3	47
W.C. Dil.	"	24	90-83	2-3	14-7	46
LV4	"	26	96-100	2-3	8-5	46
LV4 Dil.	"	19	80-97	2-3	17-10	43
ACP 649	"	12	99-97	3-3	14-9	54
ACP 926	"	11	100-100	2	10-17	70
BK 32	"	20	100-100	2	36-7	72
Weedar 80	"	17	88-92	1-2	12-30	71
ACP 904	"	22	96	1-1	14-18	82

Note: W.C. - Weedone Concentrate; W.C. Dil. - W.C. reduced to 9.6% ac. eq.; LV4 - butoxy ethanol ester of 2,4-D; LV4 Dil. - LV4 reduced to 9.6% ac. eq.; ACP 649 - pentasyl ester of 2,4-D; ACP 926 - mixture of acids of 2,4-D and 2,4,5-T; BK 32 - mixture of esters of 2,4-D and 2,4,5-T; Weedar 80 - amine salt of 2,4-D; ACP 904 - ester of MCP.

Control of Russian knapweed (Centaurea repens) with four different chemicals. Shafer, N. E. and Sand, P. F. Quadruplicate plots 10 ft x 10 ft of Russian knapweed were treated with CMU at 80, 120, and 160 lb/A, 2,4-D micronized acid at 40, 80, and 120 lb/A, polybor chlorate at 10 and 15 lb/sq rod, conc. borascu at 15 and 30 lb/sq rod and CMU plus 2,4-D micronized acid mixed at 20 lb each per acre. The treatments were applied May 3, 1952, the temperature was 80° and the soil surface dry. Stand counts were made from permanent sq. yd. quadrats established in the plots and per cent kill obtained from the reduction in stand in the quadrats. The plots were on Lamoure silty clay loam, poorly drained, and high in lime. Stand counts made June 11, 1953, showed that CMU at 80, 120, and 160 lb/A gave 100, 90, and 100% kill, 2,4-D micronized acid at 40, 80, and 120 lb/A gave 72, 81, and 91% kill, polybor chlorate at 10 and 15 lb/sq rod gave 90 and 100% kill, concentrated borascu at 15 and 30 lb/sq rod gave 97 and 100% kill and CMU and 2,4-D micronized acid mixed at 20 and 20 lb/A gave 97% kill. (Contribution of the Department of Agronomy, College of Agriculture, Lincoln, Nebraska.)

Hoary cress

Control of Hoary cress (Cardia draba) with 2,4-D and CMU. Shafer, N. E. and Sand, P. F. Triplicate sq. rod plots of hoary cress were treated with 2,4-D micronized acid at 10, 20, and 30 lb/A applied both wet and dry and CMU at 40 and 80 lb/A. The plots were on Crete, Sharpsburg silty clay loam of medium to rapid surface drainage and internal drainage moderate to slow. Initial treatments were applied May 8, 1951, when the plants were in the late rosette to early bud stage. Retreatments were made with all rates of 2,4-D, but not with CMU, on May 29, 1952, when the hoary cress was in the early bloom stage. All treatments were applied in 80 gallons of water per acre. Permanent quadrats were established in the plots and per cent kill was determined by stand counts. The table gives average per cent kill for 1952 and 1953.

Average Per cent kill	2,4-D micronized acid						CMU	
	lb/A dry			lb/A wet			lb/A	
	10	20	30	10	20	30	40	80
4-16-52	74	88	97	90	97	96	99	98
5-6-53	88	95	97	96	97	99	99	100

(Contribution of the Department of Agronomy, College of Agriculture, Lincoln, Nebraska.)

Control of Hoary cress (Cardaria draba) with 2,4-D. Shafer, N. E. and Sand, P. F. Triplicate sq. rod plots of hoary cress were treated with 2,4-D isopropyl ester at 2 and 10 lb/A, 2,4-D butoxy ethanol ester at 2 and 10 lb/A and 2,4-D micronized acid at 2 and 10 lb/A. The plots were on Crete, Sharpsburg silty clay loam of medium to rapid surface drainage and internal drainage moderate to slow. Initial treatments were made November 7, 1950. The soil was moist and the rosettes were growing actively. Retreatments

were made April 8, 1952, in the rosette stage the rosettes were growing actively, and on October 18, 1952, in the rosette stage. The soil was dry following a dry fall. Permanent quadrats were established in the plots and per cent kill was based on stand counts. All treatments were applied in 40 gal. of water per acre.

Average Per cent kill	Isopropyl Ester lb/A		Butoxy ethanol ester lb/A		2,4-D micronized acid lb/A	
	2	10	2	10	2	10
10-15-53	88	100	87	98	83	97
5-6-53	91	98	97	100	66	97

(Contribution of the Department of Agronomy, College of Agriculture, Lincoln, Nebraska.)

Rates and formulations of translocated selective herbicides on Hoary cress (Cardaria draba). Szabo, Steve S. and Zahnley, J. W. Three series of square rod plots of hoary cress were treated in the late bud and early bloom stage, May 23 - June 1, 1953, with 2,4-D and MCP. At rates of 2, 3, and 3 (1 lb at two day intervals) lb/A, the high volatile ethyl ester of 2,4-D yielded 44%, 50%, and 38% control, respectively. For the same rates, the low volatile butoxy ethanol ester of 2,4-D yielded 47%, 51%, and 39% control, respectively. Also for the above rates, the diethanolamine salt of MCP yielded 30%, 34% and 31% control, respectively. At rates of 1, 2, 3, and 2 (1 lb at two day intervals) lb/A, the low volatile iso-octyl ester of 2,4-D yielded 43%, 48%, 31%, and 33% control, respectively. The percentage control was based on per cent of fall regrowth as compared to that of the check plots. Unusually dry weather conditions and periods of unusually high temperatures reduced the effectiveness of the chemicals. (Contribution of the Kansas Agricultural Experiment Station.)

(Received late)

The effect of herbicides on Russian knapweed. McCurdy, E. V. For the past two years plots of an established stand of Russian knapweed growing in competition with brome grass have been treated with 1/2 lb/A of an ester of 2,4-D; 2 lb/A of an ester of 2,4-D; 1/2 lb/A of a mixture of 2,4-D and 2,4,5-T and also 2 lb/A of the same mixture. Top growth was efficiently killed by all applications but regrowth was not prevented. Definite thinning has occurred, more so with the heavy rate than the light, but after over two years the weed has not been eradicated. MCP at 12 oz/A and MCP 5 (a butyl ester) at 10 oz/A caused distortion of the top growth and a temporary setback but very little was accomplished by their use. Two years of black summerfallow have not resulted in complete eradication. A combination of cultural methods and a low volatile ester of 2,4-D at 2 lb/A resulted in almost complete eradication. Sodium chlorate at 3 1/2 lb/100 sq. ft. and a mixture of 2 lb. sodium chlorate and 1 1/2 lb. 2,4-D gave excellent control. In 1953 polybor chlorate at 3 lb/100 sq. ft. resulted in complete control and by freeze up regrowth had not occurred. Borascu was applied at 5 lb. per 100 sq. ft. There was severe damage to the brome but the knapweed was not killed. CMU was applied at 40 lb/A and resulted in a very complete kill of grass but Russian knapweed plants were still growing. By fall they appeared somewhat less vigorous. CMU at 40 and an ester of 2,4-D at 1 lb/A caused less injury to the brome but there was only a temporary setback to the weed. (Contributed by the Dominion Experimental Farm, Indian Head, Saskatchewan.)

LEAFY SPURGE

Summary — H. E. Leed

Three abstracts only concerning the use of chemicals for the control of leafy spurge were submitted. These dealt mainly with comparing the effectiveness of various chemicals.

Miller and Heggeness found: 2,4-D superior to MCP; spring application more effective than fall, with a combination of the two best; under the most favorable treatments drastic reduction in spurge stand but not eradication was obtained. In comparing polybor-chlorate, polybor and concentrated borascu, the former proved the most effective, giving 100% eradication of spurge.

Pavlychenko's trials revealed: butoxy ethanol and ethyl esters to be more effective than mixtures of 2,4-D and 2,4,5-T or MCP; the flowering rather than the bud stage as the more desirable period to apply chemical; 4 lbs. per A chemical to be more effective than 2 lbs; under the most favorable treatment where the spurge was in active competition with crested wheat grass, a very large measure of control of spurge was effected, with a vigorous and reasonably uniform stand of grass taking its place.

Wood found MCP sodium salt and ester less effective in top killing leafy spurge than 2,4-D butyl ester. Fifteen months after applying CMU, dosages lower than 100 lbs. per A were ineffective; a few weak plants were found in plots treated at the rate of 100 lbs.

A review of the trials, from various sources over the past several years, in which 2,4-D has been applied to leafy spurge, suggests that even after repeated applications over two seasons or more, seldom has complete eradication of the weed been obtained. Usually such treatment substantially reduces the stand of leafy spurge.

Abstracts of Results of Cooperators

Control of leafy spurge (Euphorbia Esula) by herbicides. Miller, J. H., and Heggeness, H.G. Three herbicides (low volatile ester of 2,4-D dimethylamine of 2,4-D, and an amine of MCP) were applied to a natural infestation of leafy spurge in a non-tillable sandy pasture. The applications were made spring only, spring and fall, and fall only for a period of 2 years. The rate of application was 3 lb. acid in 20 gallons of water per acre. A summary of results of this study is shown below:

	Reduction in stand (percent) at various times of application		
	Spring only	Spring and Fall	Fall only
2,4-D low volatile ester	90	95	40
2,4-D, dimethylamine	82	95	60
MCP, amine	60	65	0

Leafy spurge was not eradicated, but the drastic reductions in stand were very significant. In all cases, the treated spurge was greatly reduced in vigor. Spring applications were more satisfactory than fall applications and the combination of the two was superior to either one alone. The two 2,4-D formulations were superior to MCP for leafy spurge control.

Observations 2 years following the application of 6 and 8 lb./sq. rod of polybor-chlorate, 6 and 8 lb./sq. rod polybor, and 10 and 12 lb./sq. rod concentrated borascu, show survival of scattered leafy spurge plants on all of the treated plots except polybor-chlorate plot. Polybor was somewhat superior to concentrated borascu. A few scattered perennial grass plants also survived all of the treatments, the survival being best with polybor and least with polybor-chlorate. Some weedy annual vegetation was present on all plots at the close of the second year. (Contribution of USDA, BPIS and AE, Division of weed Investigations; and Minnesota Agric. Exp. Stn. Department of Plant Pathology and Agric. Botany). Scientific Paper No. 3083, Minnesota Agricultural Experiment Station.

Effect of systemic herbicides on leafy spurge (Euphorbia Esula), 1951-1953. Pavlychenko, T.K., Bestrop, A.J. In 1951 large size plots were treated in a pasture sown to crested wheat grass (Agropyron cristatum) in 1950. Weed population of 300 or more per sq. yd. with only occasional grass was the general situation. The treatments were made at the bud stage in one series and at the flowering stage in another. Micronized acid of 2,4-D (ACP 472); ethyl ester of 2,4-D (Weedone Concentrate), 40 pct. and 9.6 pct.; butoxy ethanol ester of 2,4-D (Weedone LV4), 40 pct. and 9.6 pct.; pentasyl ester of 2,4-D, mixture of esters of 2,4-D and 2,4,5-T (Brush Killer 32) and amine salt of MCP (Weedar MCP) at 2 and 4 lb./A rates were the chemicals used at the earlier date. The rates were increased to 3 and 6 lb./A in the later series. Similar treatments in every respect were repeated in 1952, with the exception that less effective chemicals, namely MCP and Brush Killer 32 were dropped, and a mixture of 2,4-D, 2,4,5-T and para esters (ACP 912) and a mixture of 2,4-D and 2,4,5-T acids (ACP 926) were used instead. In both seasons the ethyl and butoxy ethanol esters at both rates and concentrations were much more effective than comparable treatments with other materials. The series treated later gave a better kill of the weeds and greater improvement of the grass. In 1953, only the butoxy ethanol and ethyl esters in the same concentrations as in 1951 and 1952 were used as the most effective chemicals at 2 and 4 lb./A rates at the late bud stage. In the fall of 1953, only occasional weak weeds amounting to 1.7 pct. of the original weed population was recorded with the 4 lb./A of Weedone LV4 and 2 pct. with Weedone Concentrate. At lower rates, regrowth was up to 22 pct. with both chemicals. At this time the grass was very vigorous and reasonably uniform in spite of scarcity of grass plants two years ago. (Contributed by Agriculture Division, American Chemical Paint Company, Saskatoon, Sask.)

The effectiveness of various chemicals were compared in the control of leafy spurge. Wood, H.E., Craig, H.A., Fox, W.B. Moderately heavy infestations of leafy spurge, Euphorbia Esula, in native grass on light loam soil near Winkler, were knapsack sprayed at rates of 1, 2 and 4 lb. acid equivalent in 80 imperial gallons water per A, in which MCP sodium salt, MCP butyl ester and 2,4-D butyl ester were compared. Application was made June 23, when the spurge was in bloom to setting seed. One month later all top-growth was killed on the 2,4-D plots. With MCP sodium salt only a partial kill was obtained and only at the 4 lb. rate. MCP ester gave very little control at 1 lb; partial at 2 lbs. and still more at 4 lbs. (but less than 1 lb. 2,4-D). Observations were made September 23, 1953 of leafy spurge in competition with native grass plots which were treated July 8, 1952 with CMU at rates of 25, 50, 75 and 100 lbs. active per A. Only at 100 lbs. was there nearly complete eradication of spurge - only weak and scattered plants remained. (Contribution from the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada).

TOADFLAX AND OTHER HERBACEOUS PERENNIAL WEEDS

Summary

H.A.Friesen

Toadflax control studies were reported on in four abstracts. On arable land a system of alternate intensive tillage of fallow and cropping to barley has reduced the stands of toadflax to the extent that the weed did not depress the yield of grain. Seeding infested land to crested wheat and then spraying with a 2,4-D ester at 2 to 3 lbs./A has, over the past five year period, reduced the stand of toadflax by over 60 pct. Esters of 2,4-D and 2,4,5-T used singly or mixed, polyethylene glycol ester, butoxy ethanol ester and pentasyl ester of 2,4-D each at 2 and 4 lbs./A gave 80 pct. top kill but had essentially no effect on the roots. CMU at 80 and 100 lbs./A has prevented the regrowth of toadflax for a period of 3 years. CMU sprayed at 20 lbs./A in 1951 and again in 1953 has given similar control. Sodium chlorate, polybor chlorate and borascu were found to be less effective than CMU. TCA and MH were ineffective.

Bur ragweed (Franseria tomentosa) was treated with 2,4-D esters and amine, MCP amine, butoxy ethanol ester and 2,4,5-T ester at dosages which ranged from 1 to 16 lbs./A. Consistently good control was obtained with 2,4-D ester and the butoxy ethanol ester when applied in the pre-bud stage at dosages of 2 lbs./A and up.The use of diesel oil instead of water as a diluent enhanced the effectiveness of 2,4-D. 2,4,5-T and MCP were noted to be less effective than 2,4-D. The stand of (Franseria discolor) was reduced 90 pct. by 2 lbs./A of either butoxy ethanol ester or 2,4-D ester applied in the rosette stage. No control resulted from these treatments applied during bloom stage. Sodium chlorate at 4 lbs./rd soluble borate and borate-chlorate mixture each at 6 lbs./rd resulted in 95 pct. kills. CMU at 40 lbs./A and up resulted in good but not complete kills.

Pasture sage was killed to the ground by butoxy ethanol ester and ethyl ester of 2,4-D and a 2,4-D and 2,4,5-T mixture each at 2 lbs./A in 1953. However, regrowth from the crowns was as high as 50 pct. in the same season.

Poverty weed was effectively controlled in the bloom stage with 2,4-D esters, both isopropyl and butoxy ethanol, at 2 lbs./A and with CMU at 20 lbs./A. The 2,4-D ester and amine were found to be more effective if applied during the bud stage.

Tanweed was not satisfactorily controlled with CMU even at 120 lbs./A. 2,4-D at 60 and 120 lbs./A each resulted in 91 pct. kill of tanweed.

Blueweed was controlled with CMU at dosages of 40 lbs./A and up. The addition of 2,4-D amine at 2 lbs./A to the CMU did not improve the control. 2,4-D alone was ineffective.

Field horsetail and Western snowberry were not satisfactorily controlled with CMU at dosages of 20, 40, and 60 lbs./A in 80 gals./A of water.

Abstracts of Results of Cooperators.

Toadflax.

Tillage and cropping methods for the control of Toadflax (Linaria vulgaris). Friesen H. A. and C. H. Keys. In 1949 four crop rotations were laid down on land heavily infested with toadflax. The rotations were 1) fallow, barley; 2) fallow, fallow, wheat; 3) fallow until Sept. 15 then seed down to fall rye, harvest fall rye and partial fallow before again seeding fall rye on Sept. 15, harvest fall rye and fallow until freeze-up, seed wheat; 4) fallow, wheat, oats. The fallow in each rotation, except rotation 4, was given shallow tillage at intervals spaced sufficiently close together to prevent green regrowth from appearing above the ground for more than 8 days at any time. Observations made in October 1953 showed that the alternate fallow and barley and the fallow, fallow, wheat rotations had reduced the original stand of toadflax by over 90 pct. Examination of the plots showed that the surviving plants had largely sprung from the seed. The fallow, barley rotation has had a wider practical application than the fallow, fallow, wheat rotation because the degree of control was as good and could be obtained without the heavy loss of crop revenue and the greater hazard of soil erosion. The length of time required for complete control would be contingent on the longevity of the seed in the soil provided that re-infestation from neighboring areas does not occur. The rotation which involved the use of fall rye has been only 50 pct. as effective for the control of toadflax as the two previous rotations because the weed tended to re-establish itself rather quickly in the rye. On the plots in which a fallow (not intensively cultivated), wheat, oats rotation was used the infestation of toadflax has markedly increased during the past five-year period. (Contributed by the Dominion Experimental Station, Station, Scott, Sask.)

Effect of repeated applications of 2,4-D on toadflax (Linaria vulgaris) on land seeded down to crested wheatgrass. Friesen H. A. and C. H. Keys. A two acre plot of land heavily infested with toadflax was seeded down to crested wheatgrass in the late fall of 1948. In each of the following seasons portions of the grassed area were sprayed with 2,4-D ester and amine at dosages which ranged from ½ lb./A to 4 lb./A. In both 1950 and 1951 the treatments were repeated twice in the same season. The grass plants did not begin to invade and establish themselves within the toadflax patches until mid-summer of 1952. In October of 1953 the areas treated with 2,4-D amine at 3 lb./A and the 2,4-D ester at 3 and 4 lb./A had 60 pct. less toadflax than the unsprayed but seeded down check strip. The ½ and 1 lb./A rates of either 2,4-D ester or amine did not significantly reduce the toadflax infestation when compared with the check. Observations of other tests have shown that similar or better control could be obtained with less 2,4-D and in a much shorter time if one season of intensive tillage was carried out previous to seeding down the grass. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Approved for publication.

H. A. Friesen for publication.

Control of toadflax by 2,4-D in combination with a competitive grass. Carder, A. C. An area heavily infested with toadflax, (Linaria vulgaris), was summer worked and a seed bed prepared. The following spring one-half of the area was seeded to bromegrass, the other half to creeping red fescue. Good stands of grass were obtained along with a considerable growth of toadflax consisting of seedlings and resprouts from old plants. No nurse crop was used with the grass. In late July when the toadflax had reached the late bud stage the butyl ester of 2,4-D was applied at nil, 1, 2, 3 and 4 pounds per acre in a water spray at the rate of 5 gallons per acre. Autumn examination indicated the top growth of toadflax growing with brome to be suppressed 40, 50, 70 and 70 per cent where the 1, 2, 3 and 4 pounds per acre rates of 2,4-D had been applied, respectively. Corresponding figures for the fescue plots were 10, 20, 60 and 70 per cent top-growth suppression. No viable toadflax seed could be found where 2,4-D had been applied at any rate. The experiment will continue for several years using repeated 2,4-D applications. (Contribution of Dominion Experimental Station, Beaverlodge, Alberta).

The effect of various herbicides on toadflax, (Linaria vulgaris). Carder, A. C. The chemicals utilized in this test were: phenyldimethylurea (Urab), CMU and sodium chlorate. The last was applied dry at three stages of growth of the toadflax, namely, early rosette, late bud stage and in the autumn. The rates used were 2, 4 and 6 pounds per square rod. The CMU was applied at the late bud stage and in the fall at rates of 20, 30, 40, 50 and 60 pounds per acre; the Urab only at the late bud stage at rates of 20, 40, 80 and 100 pounds per acre. Both of the latter chemicals were applied in a water spray at the rate of 80 gallons of water per acre. Examination in mid-September indicated kills where the sodium chlorate had been applied at the rosette stage were 96, 98 and 99 per cent for the 2, 4 and 6 pound rates, respectively. The corresponding figures for the late bud application were 98, 100 and 100 per cent. Where CMU was applied at the late bud stage, percentage kills were 40, 75, 88, . 94 and 95 for the 20, 30, 40, 50 and 60 pound rates, respectively; while with Urab the percentage kills were 20, 65, 96 and 98 for the 20, 40, 80 and 100 pound rates, respectively. The killing action of the fall treatments of sodium chlorate and CMU could not be appraised. The full outcome of these trials will not be known until 1954. (Contribution of Dominion Experimental Station, Beaverlodge, Alberta).

Effect of herbicides on toadflax (Linaria vulgaris) 1951-1953. Friesen H.A. and C.H. Kays. In May 1951, sodium chlorate at 1, 2, and 3 lb./100 sq. ft; CMU and TCA each at 20,40,80 and 100 lb./A; polybor chlorate at 3 lb./100 sq.ft. and borascu at 6 lb./100 sq. ft; MH at 24 lb./A and DNOSBP (general) at 10 gal./A mixed in diesel oil at 160 gal./A were applied to toadflax. The stand of toadflax was dense, some 400 plants/sq. yd., and was growing on land which had not been cropped since 1948. In October of 1953, those plots treated with sodium chlorate at 1,2, and 3 lb./100 sq. ft. showed regrowth of toadflax equal to 60,45, and 33 pct. of the original stand in 1951, respectively. Plots treated with polybor chlorate at 3 lb./100 sq. ft. had 38 pct. regrowth, which indicated that at comparable rates polybor chlorate and sodium chlorate resulted in closely similar control. Only some 20 pct. regrowth was noted on plots treated with borascu, however, these plots were heavily infested with Russian thistle and wild barley. MH and TCA resulted in very unsatisfactory control. The CMU treatments resulted in the most outstanding control of toadflax. There was no growth on those plots treated with 80 and 60 lb./A of CMU, those treated with 40 lb./A had 2 pct. regrowth. On the plots treated with CMU at 20 lb./A there was 9 pct. regrowth when they were retreated with 20 lb./A of CMU in the spring of 1953. In October 1953 there was no growth of any kind to be found on these plots.There was no growth noted on the plots treated with DNOSBP in diesel oil. Wheat planted on the plots treated with sodium chlorate, polybor chlorate, TCA and MH grew and matured seeds but on those plots treated with CMU or DNOSBP in oil the wheat died before it reached a height of 3 inches. Mixtures of sodium chlorate and 2,4-D ester in the ratio of 3 lb./100 sq. ft.: 4 lb./A; CMU and sodium chlorate in the ratio of 40 lb./A : 160 lb./A resulted in no better control than when the sodium chlorate and CMU, respectively, were applied alone.

In June 1953 a preliminary trial, in which CMU and Compound 2049 were each sprayed at 20,40,80 and 100 lb./A, was laid down on a heavy stand of toadflax in a cultivated field. Compound 2049 is reputed to have properties similar to CMU. In October of 1953 each of these herbicides had resulted in complete kills of the top growth. Regrowth equal to some 12 pct. of the original stand was noted on the plots treated with either compound at the rate of 20 lb./A. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Approved for publication.

The effect of systemic and contact herbicides on toad flax (Linaria vulgaris) 1952-1953. Pavlychenko, T.K., and Bestrop, A.J. Replicated sq. rod plots growing on sandy loam soil were treated in the prebud stage in 1952 with 2 and 4 lb./A rates of mixture of esters of 2,4-D and 2,4,5-T (Brush Killer 32), mixture of acids of 2,4-D and 2,4,5-T (ACP 926), polyethylene glycol ester of 2,4-D (ACP 648), butoxy ethanol ester of 2,4-D (Weedone LV4),ethyl ester of 2,4-D (Weedone Concentrate), mixture of esters of 2,4-D, 2,4,5-T and para (ACP 912), pentasyl ester of 2,4-D (ACP 649) and at 20 and 40 lb./A rates of 3-p-chlorophenyl-1-1-dimethylurea (CMU). RESULTS: Preliminary results were given in the 1952 NCWCC Research Report. At that time CMU was the only chemical which 100 pct. top kill. The esters of 2,4-D gave 80 pct. or more top kill, but all the chemicals used had only slight effect on roots. In the fall of

1953, the recovery of toadflax was general in all treatments excepting CMU, which caused some soil sterility, and thereby the recovery of the weed was also considerably but not fully prevented. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Bur Ragweed

The effect of 2,4-D and 2,4,5-T on bur ragweed (Franseria tomentosa). Phillips, W. M. A heavy stand of bur ragweed was treated June 14, 1952, while in the pre-bud stage with the following chemicals: 2,4-D ester and 2,4,5-T ester at 1, 2, 4, 8, and 16 pounds per acre applied in water, 1,2, and 4 lb./A applied in 20 gal. of diesel fuel and 1, 2, and 4 lb./A applied in a 1 to 3 oil-water emulsion at 20 gal./A; 2,4-D amine at 1, 2, 4, 8, and 16 lb./A applied in water and 1, 2, and 4 lb./A applied in a 1 to 3 oil-water emulsion at 20 gal./A. The applications were made during a period of extremely low rainfall and the deficiency of moisture continued for the remainder of 1952 and extended throughout the year of 1953. Notes taken 13 months after application showed that 2 lb. of 2,4-D ester applied in 20 gal. of diesel fuel per acre gave consistently good results. This treatment resulted in an average reduction in stand of approx. 85 pct. Most treatments gave some reduction in stand but some of the applications were not effective. There was a great variation between the replicates of most of the treatments with the results varying from over 90 pct. reduction in stand to a little reduction. The 1 and 2 lb. of 2,4-D amine applied in water did not prevent seed production in 1952. The same rates applied in an oil-water emulsion were effective in preventing seed production and the 2 and 4 lb. of 2,4-D amine when applied in an emulsion were nearly as effective as the 2 lb. of ester in oil. The 2,4,5-T did not appear to be as effective as the 2,4-D formulations. A similar experiment was started in 1953. (Contributed by Division of Weed Investigations, BPISAE, USDA, Hays, Kansas)

The use of soil sterilizing chemicals for the control of bur ragweed (Franseria tomentosa). Phillips, W. M. Sodium chlorate at 4, 6, and 8 lb./sq. rod; soluble borate (77 pct. sodium pentaborate) at 2, 4, 6, 8, and 10 lb./sq. rod; borate-chlorate mixture (71 pct. borate- 25 pct. sodium chlorate) at 2, 4, 6, 8, and 10 lb./sq. rod; and CMU at 40, 80 and 120 lb./A were applied to a heavy stand of bur ragweed May 14, 1952. The following 18 months were extremely dry with little effective rainfall occurring during the entire period. Notes taken in May of 1953, and observations in the fall of 1953 showed that sodium chlorate at all rates was effective in reducing the stand of bur ragweed. At the lowest rate used this chemical killed more than 95 pct. of the weed. The original application of 2 and 4 lb./sq. rod of the soluble borate and borate-chlorate mixture were not effective in reducing the stand and these plots were retreated in 1953. Even though retreated, results were not as satisfactory as on those plots which received higher rates of chemical in the original application. Six, 8, and 10 lb./sq. rod of both chemicals gave results which were equal to sodium chlorate. CMU at all rates caused considerable reduction in stand and greatly reduced the vigor of the surviving plants but even the highest rate did not kill all of the bur ragweed which was present on the plots. (Contributed by Division of Weed Investigations, BPISAE, USDA, Hays, Kansas.)

Control of bur ragweed (Franseria tomentosa) and (Franseria discolor) with 2,4-D and MCP. Sand, P. F. and Shafer, N. E. (Franseria tomentosa) was treated at three stages of growth with 2,4-D isopropyl ester, triethanol amine salt of 2,4-D, MCP diethanol amine, and butoxy ethanol ester of 2,4-D at rates of 1 and 2 lb./A in 1952. Three replications of sq. rod plots were treated with a knapsack sprayer with a three nozzle boom. The plot area was in a field of winter wheat that was plowed and seeded to wheat again in the fall of 1952. Stand counts taken June 22, 1953, showed the rosette stage sprayed May 20 gave no decrease in stand with any chemicals or rates. The pre-bud stage treated June 18 gave decreases in stand only with isopropyl ester and butoxy ethanol ester. The isopropyl ester at 1 and 2 lb./A giving 6 and 58 pct. kill and the butoxy ethanol ester 26 and 66 pct. kill, respectively. No decrease in stand resulted from treatment with these four chemicals August 8 when the plants were in the bud stage.

(Franseria discolor) was treated in Kimball County with the same chemicals and rates June 12, 1952, in the rosette stage and August 25 in the bloom stage. At the time of spraying in June the plants were 2-3 in. tall and growing vigorously in a field of spring planted barley. However, at the time of the August treatments the weeds were not growing vigorously due to a dry period. Visual estimates of reduction in stand were made June 11, 1953. The isopropyl ester at 1 and 2 lb./A gave 70 and 90 pct. reduction in stand, the triethanol amine salt at 1 and 2 lb./A gave 44 and 88 pct. reduction in stand, MCP diethanol amine at 1 and 2 lb./A gave 13 and 73 pct. reduction and butoxy ethanol ester at land 2 lb./A gave 83 and 90 pct. reduction in stand. No control resulted from any of the August 25 treatments. (Contributed by Department of Agronomy, College of Agriculture, Lincoln, Nebraska.)

Other Herbaceous Perennial Weeds

Effect of systemic herbicides on pasture sage (Artemisia frigida) 1952-1953. Pavlychenko, T. K. and Bestrop, A. J. Plots 8 x 100 ft., in an overgrazed bromegrass pasture, were treated in the late flowering stage with 1½ and 3 lb./A rates of ethyl ester (Weedone Concentrate) and butoxy ethanol ester (Weedone LV4) of 2,4-D both at 40 and 9.6 pct. concentration, another butoxy ethanol ester of 2,4-D (ACP 129), pentasyl ester of 2,4-D (ACP 649), amine salt of 2,4-D (Weedar 80), amine salt of MCP (Weedar MCP), mixture of 2,4-D and 2,4,5-T esters (Brush Killer 32), mixture of 2,4-D and 2,4,5-T acids (ACP 926), ester of para (ACP 903) and ester of MCP (ACP 904). Moisture conditions were fair throughout the season. RESULTS: 1952 results were given in the 1952 NCWCC Research Report. At that time Weedone LV4, ACP 129, Weedone Concentrate Dilute and ACP 649 gave a good kill of top growth and the new shoots showed strong abnormalities. The remaining chemicals were less effective in killing tops and the new shoots were almost normal. No further treatments were applied in 1953, and the pasture sage had recovered in all plots to the extent of the original population. Bromegrass stand was not significantly improved. The fact that the pasture was not protected from heavy grazing and trampling after the treatments may have contributed materially to the poor results recorded in 1953. (Contributed by Agr. Division American Chemical Paint Company, Saskatoon, Sask.)

Effect of systemic herbicides on pasture sage (Artemisia frigida), 1953. Pavlychenko, T. K. and Bestrop, A.J. Plots 8 x 125 ft., located on overgrazed native prairie pasture, were treated in the early flowering stage with 1 and 2 lb./A rates of butoxy ethanol esters (Weedone LV4) and ethyl esters (Weedone Concentrate) of 2,4-D both at 40 and 9.6 pct. concentrations, amine salts of 2,4-D (Weedar 80 and ACP 127), amine salt of MCP (Weedar MCP) and mixture of esters of 2,4-D and 2,4,5-T (Brush Killer 32). RESULTS: The 2 lb./A rates of Weedone Concentrate Dilute, Weedone LV4, Weedone LV4 Dilute, Brush Killer 32 and Weedone Concentrate produced stem kills of 97 to 82 pct. In the fall the regrowth from crowns was from 50 to 30 pct. The 1 lb./A rates of the above chemicals gave still lower stem kill amounting to 65 to 50 pct., and the regrowth, 75 to 20 pct. The remaining group of treatments gave relatively poor top kill, 25 to 10 pct., and about the same amount of regrowth. In the more effective treatments, the stand of native grass was much improved, but no improvement was recorded in the less effective treatments. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

DATA

Treatment	Rate lb./A	Stem Kill pct.	Regrowth pct.
LV4	1	65	75
LV4	2	95	30
LV4 Dil.	1	62	72
LV4 Dil.	2	95	33
W.C.	1	50	20
W.C.	2	82	50
W.C. Dil.	1	50	20
W.C. Dil.	2	97	35
Weedar 80	1	20	15
Weedar 80	2	25	12
ACP 127	1	18	15
ACP 127	2	22	15
MCP	1	10	10
MCP	2	15	11
BK 32	1	50	40
BK 32	2	85	30

Note: LV4 - butoxy ethanol ester of 2,4-D; LV4 Dil. -LV4 reduced to 9.6 pct. ac. eq.; W.C. -Weedone Concentrate; W.C. Dil. - W.C. reduced to 9.6 pct. ac. eq.; Weedar 80 - and ACP 127 - amine salts of 2,4-D; BK 32 - mixture of esters of 2,4-D and 2,4,5-T.

Control of poverty weed (Iva axillaris) with 2,4-D and CMU. Sand, P. F. On June 26, 1951, poverty weed was treated in the bloom stage with triethanol amine salt of 2,4-D, butoxy ethanol ester of 2,4-D, isopropyl ester of 2,4-D, micronized acid of 2,4-D each at 2 and 10 lb./A, and CMU at 5, 10 and 20 lb./A. The plots 8 x 16 ft. were replicated 3 times and located in Dawes County. Duplicate sq. rod plots of poverty weed were treated June 13, 1952, with triethanol amine salt of 2,4-D and isopropyl ester of 2,4-D at ½, 1 and 2 lb./A. The weeds were 4 to 6 in. tall in the bud stage growing actively on summer fallow land. Per cent kill was determined by visual estimate comparing treated plots with the checks.

Chemical	1951 Treatment		1952 Treatment	
	lb./A (Applied 6/26/51)	pct. kill 6/13/52	lb./A (Applied 6/13/52	pct.Kill 6/10/53)
Triethanol amine	2	55	½	0
	10	91	1	77
			2	88
Isopropyl ester	2	90	½	10
	10	87	1	80
			2	93
Butoxy ethanol ester	2	82	-	--
	10	66	-	--
Micronized acid of 2,4-D	2	60	-	--
	10	95	-	--
CMU	5	66	-	--
	10	72	-	--
	20	95	-	--
Check	--	0	-	0

(Contribution of Department of Agronomy, College of Agriculture, Lincoln, Nebraska).

Control of tanweed (Polygonum coccineum) with CMU and 2,4-D. Shafer, N. E. and Sand, P. F. Two series of 10 x 10 ft. plots, one mowed and the other unmowed, were treated with CMU at rates of 10, 20, 30, and 40 lb./A on June 16, 1951 on Waukesha silty clay loam. CMU at 60 and 120 lb./A was applied to tanweed June 9, 1952. The mowed series of the 1951 plots were also retreated at this date with CMU at the same rates previously used. Stand counts made June 3, 1952, on the plots treated in 1951 showed that CMU at 10, 20, and 30 lb./A gave no control, but 40 lb./A gave 3 pct. kill in the unmowed series and 15 pct. kill in the mowed series. Per cent control June 11, 1953, on the unmowed plots treated in 1951 with no further treatment was 0, 17, 0, and 10 pct. kill, respectively, for 10, 20, 30 and 40 lb./a of CMU. For the mowed plots that were treated with these same applications for two consecutive years the pct. control was 30, 13, 15, and 55 pct. respectively. CMU applied in 1952 at the rate of 60 and 120 lb./A gave 5 and 63 pct. kill of tanweed by June 11, 1953, and 2,4-D at 60 and 120 lb./A both gave 91 pct. kill of tanweed. (Contribution of Department of Agronomy, College of Agriculture, Lincoln, Nebraska).

Control of blueweed (Helianthus ciliaris) with CMU and 2,4-D. Wiese, A. F. and Rea, H. E. On August 12, 1953, 1/40 acre plots were treated with 2 lb. of 2,4-D amine /A and 20, 40, and 60 lb./A of CMU with and without 2 lb./A of 2,4-D amine. Two lb./A of 2,4-D amine alone reduced the stand slightly but did not prevent seed formation in 1953. Treatments of CMU with 2,4-D amine were no more effective than CMU alone. All treatment with CMU prevented seed formation and the 40 and 60 lb./A rates gave good control of blueweed. The 20 lb./A treatment reduced the stand of blueweed about 50 pct. Those plants remaining were abnormal, showing severe brittleness and yellowing of the stems and leaves. The rainfall from August 1952 to October 1953 was approx. 14 inches. (Contribution from the Amarillo Experiment Station, U.S.D.A and Texas Agricultural Experiment Station cooperating).

Control of stinging nettles with chlorophenoxyacetic acid herbicides. Hamilton, K.C. and Buchholtz, K. P. In the spring of 1951 nettles (Urtica prosera) were treated with amine salts of 2,4-D, 2,4,5-T and MCP at 0.25, 0.5 and 1.0 lb./A when the plants were from 4 to 8 in. tall. Another series of plots was treated with a sodium salt of 2,4-D at 0.5, 1.0 and 2.0 lb./A and an amine and the ethyl ester of 2,4-D each at 0.25, 0.5 and 1.0 lb./A when the plants were about 18 in. tall. All chemicals were applied in water equivalent to 40 gal./A and treatments were replicated four times. The initial kill of nettle top growth was 100 pct. on all treated plots. Observations during 1951 and 1952 showed no regrowth from rhizomes on any treated plot. Nettle seedlings were numerous in 1953 but few survived in competition with annual broad-leaved weeds and perennial grasses. During 1952 and 1953 there was considerable encroachment into treated plots from the untreated check plots and the nettles surrounding the treated plots.

On plots where the nettles had been dense enough to have excluded perennial grasses the vegetation which replaced the nettles after treatment was annuals such as redroot, black mustard, lambsquarters, witchgrass, Pa. smartweed and ladysthumb. On these plots the annual weeds remained dominant during the second and third summers. On plots with small scattered patches of perennial grasses, pricipally quackgrass, Ky. bluegrass and meadow foxtail, at time of treatment, a mixture of grasses and annual weeds dominated the plots the first season. In the second and third season after treatment the annual weeds were replaced by denser stands of perennial grasses.

In 1952 the ethyl ester of 2,4-D was applied at 1/12, 1/6 and 1/3 lb./A when the nettles were 3, 6, 12 and 30 in. tall. All applications resulted in 100 pct. kill of the top growth. Regrowth of nettles from rhizomes on the plots treated at the 3 in. stage equalled the growth on the untreated checks within eight weeks. No application resulted in better than 60 pct. reduction in nettle stand by the end of the first season.

In 1953 the ethyl ester of 2,4-D was applied at 0.25 and 1.0 lb./A to nettles when from 12 to 18 in. tall. The stand of nettles on treated plots in the fall of 1953 varied from 0.3 to 0.7 pct. of that on the untreated checks. It is apparent that nettle kill varies from year to year but use of 0.5 lb./A of any preparation of 2,4-D should give essentially complete rhizome kill. (Contribution of Dept. Agron., Univ. of Wis., Madison, Wisconsin).

Chemical control of pasture weeds in Northern Minnesota. Heggeness, H. G. and Larson, A. H. Herbicides were tested for three years on natural infestations of tansy (Tanacetum vulgare), buttercup (Ranunculus acris), oxeye daisy (Chrysanthemum leucanthemum), and orange hawkweed (Hieracium aurantiacum) in St. Louis County, Minnesota, where these weeds occupy many thousands of acres of potentially good pasture land. All chemicals were applied in 40 gals. of water per acre, and best treatments are outlined below:

1) Tansy. Readily controlled by a 3 lb. application of a low-volatile ester of 2,4-D prior to blooming. Practically eradicated by 2

lb. application of low volatile ester of 2,4-D in June (prior to flowering) followed by 1 lb. application of same chemical in September. In second year spray again with 1 lb. of the chemical in June.

2) Buttercup. Spray with 2 lb. of an amine formulation of MCP in early summer when the plants begin to flower, and again in September with a 1 lb. application. This procedure has caused a 98 pct. to 100 pct. reduction in stand.

3) Oxeye daisy. Spray with 2 lb. of an isopropyl ester of 2,4-D in early summer as the plants come into full bloom, but prior to the formation of seed. A second application of 2 lb. should be made between August 15 and September 1, at which time new stolons are being formed. This procedure has eradicated the weed.

4) Orange hawkweed. Spray with 3 lb. of a low volatile ester of 2,4-D in June when the plants are coming into full bloom and with 2 lb. of the chemical in September. This procedure has reduced the stands of this weed by 95 to 100 pct. An amine formulation of 2,4-D at 3 lb./A was also effective (90 pct. kill) if applied at both of the above dates. (Contribution of USDA, BPIS and AE, Division of Weed Investigations; and Minn. Agric. Expt. Station, Dept. of Plant Path. and Agric. Botany).

PERENNIAL HERBACEOUS WEEDS

H. A. Friesen

This classification is based on information obtained from the Research Reports of the NCWCC for the years 1950 to 1952 inclusive and the reports of 19 investigators in 1953. Since the tolerance of species varies geographically and the data on some species is meager, the classification is indicative rather than exact and is, therefore, subject to future change.

REACTION OF PERENNIAL HERBACEOUS WEEDS TO 2,4-D

Group I Very Sensitive Any perennial plant that is killed by one application of 2,4-D at dosages of 1 to 4 lb./A in early and late vegetative stages.

Cress, Austrian field	Rorippa austriaca
Cocklebur	Xanthium spp.
* Dandelion	Taraxacum officinale
Dandelion, fall	Leontodon autumnalis
Gumweed	Grindelia perennis
Plantain, common	Plantago major
Plantain, English	Plantago lanceolata
Plantain, Rugel's	Plantago rugellii
Sunflower	Helianthus spp.
Thistle, nodding	Carduus nutans

* Classified as "Sensitive" if treated in the late vegetative stage.

Group II Sensitive Any perennial plant that is controlled by one application of 2,4-D at dosages of 1 to 4 lb./A in early and late vegetative stages and is killed by repeated applications.

Aster, many flowered	Aster multiflorus
Bindweed, hedge	Convolvulus sepium
Bindweed, field	Convolvulus arvensis
Buttercup, tall	Ranunculus acris
Cress, Western yellow	Radicula sylvestris
Daisy, oxeye	Chrysanthemum leucanthemum
Dock, curled	Rumex crispus
Garlic, wild	Allium vineale
Hawkweed, orange	Hieracium aurantiacum
* Ironweed	Vernonia Baldwinii
* Ironweed	Vernonia interior
* Lettuce, blue	Lactuca pulchella
Mallow, round leaf	Malva neglecta
Nettle	Urtica dioica
Nettle, stinging	Urtica gracilis
Pucoon, hoary	Lithospermum canescens
* Ragweed, bur	Franseria tomentosa
* Ragweed, bur	Franseria discolor
Ragweed, perennial	Ambrosia psilostachya
Rocket, yellow	Barbarea vulgaris

Sage, pasture	Artemisia frigida
Sage, prairie	Artemisia gnaphalodes
Tansy	Tanacetum vulgare
Thistle, bull	Circium lanceolatum
Thistle, Canada	Circium arvense
Thistle, perennial sow	Sonchus arvensis
Vervain, hoary	Verbena stricta
Chickweed, mouse ear	Cerastium vulgatum

*Classified as "Semi-tolerant" if treated in the late vegetative stage.

Group III Semi-tolerant Any perennial plant that is controlled by one application of 2,4-D at dosages of 1 to 4 lb./A in early and late vegetative stages but is usually not killed by repeated applications.

Avens, three-flowered	Geum triflorum
Bedstraw, northern	Galium boreale
Bladder campion	Silene vulgaris
Blueweed	Helianthus ciliaris
Bracken	Pteris aquilina
Cress, hoary	Lepidium draba
Cockle, white	Lychnis alba
Geranium	Geranium carolinianum
Goldenrod	Solidago sp.
Horsetail, field	Equisetum arvense
Knapweed, Russian	Centaurea repens
Licorice, wild	Glycyrrhiza lepidota
Milkweed, common	Asclepiassyrica
Milkweed, whorled	Asclepias verticillata
* Milkweed, climbing	Gonolobus laevis
Poverty weed	Iva axillaris
Sorrel, sheep	Rumex acetosella
Spurge, leafy	Euphorbia esula
Tanweed	Polygonum coccineum
Toadflax	Linaria vulgaris
Yarrow	Achillea millefolium

*Classified as "Tolerant" when treated in late vegetative stages.

Group IV Tolerant Any perennial plant that is not controlled or killed by the application of 2,4-D at dosages of 1 to 4 lb./A.

Boneset, false	Kuhnia glutinosa
Brier, sensitive	Schrankia uncinata
Cacti	Optunia spp.
Couch grass	Agropyron repens
Cherry, ground	Physalis spp.
Johnson grass	Sorghum halpense
Mallow, alkali	Sida hederacea
Nettle, horse	Solanum carolinense

Group V Controllable in growing crops. Top growth may be controlled by dosages of 2,4-D within those recommended for use in cereal grain crops.

Bindweed, field	Convolvulus arvensis
Bindweed, hedge	Convolvulus sepium
Burdock	Arctium spp.
Cress, hoary	Lepidium draba
Dock, curled	Rumex crispus
Horsetail, field	Equisetum arvense
Spurge, leafy	Euphorbia esula
Thistle, Canada	Circium arvense
Thistle, perennial sow	Sonchus arvensis

REACTION OF PERENNIAL HERBACEOUS WEEDS TO 2,4,5-T

Group I Very Sensitive Any perennial plant that is killed by one application of 2,4,5-T at dosages of 1 to 4 lb./A in early and late vegetative stages.

Cacti	Optunia sp.
Burnet	Sanguisorba minor
Thistle, nodding	Carduus nutans

Group II Sensitive Any perennial plant that is controlled by one application of 2,4,5-T at dosages of 1 to 4 lb./A in early and late vegetative stages and is killed by repeated applications.

Horse nettle	Solanum Carolíninse
Bindweed, field	Convolvulus arvensis
Buttercup, tall	Ranunculus acris
Cress, hoary	Lepidium draba
Daisy, oxeye	Chrysanthemum leucanthemum
Ironweed	Vernonia interior
Nettle, stinging	Urtica prosera
Ragweed, perennial	Ambrosia psilostachya
Thistle, Canada	Circium arvense
Vervain, hoary	Verbena stricta

Group III Semi-tolerant Any perennial plant that is controlled by one application of 2,4,5-T at dosages of 1 to 4 lb./A in early and late vegetative stages but is usually not killed by repeated applications.

Knapweed, Russian	Centaurea repens
Milkweed, climbing	Gonolobus laevis
Ragweed, bur	Franseria tomentosa
Sage, pasture	Artemisia frigida
Spurge, leafy	Euphorbia esula
Tanweed	Polygonum coccineum
Toadflax	Linaria vulgaris

Group IV Tolerant Any perennial plant that is not controlled or killed by the application of 2,4,5-T at dosages of 1 to 4 lb./A

Blueweed	Helianthus ciliaris

REACTION OF PERENNIAL HERBACEOUS WEEDS TO MCP

Group I Very Sensitive Any perennial plant that is killed by one application of MCP at dosages of 1 to 4 lb./A in early and late vegetative stages.

None reported.

Group II Sensitive Any perennial plant that is controlled by one application of MCP at dosages of 1 to 4 lb./A in early and late vegetative stages and is killed by repeated applications.

Thistle, Canada	Circium arvense
Thistle, perennial sow	Sonchus arvensis
Buttercup, tall	Ranunculus acris
Stinging Nettle	Urtica prosera

Group III Semi-tolerant Any perennial plant that is controlled by one application of MCP at dosages of 1 to 4 lb./A in early and late vegetative stages but is usually not killed by repeated applications.

Knapweed, Russian	Centaurea repens
Sage, pasture	Artemisia frigida
Ragweed, bur	Franseria tomentosa

REACTION OF PERENNIAL HERBACEOUS WEEDS TO TCA

Group I Sensitive Any perennial plant that is controlled by one application of TCA at dosages of 20 to 100 lb./A in late vegetative stages. More than one treatment usually necessary for eradication.

Artichoke, Jerusalem	Helianthus tuberosus
Asparagus	Asparagus officinalis
Cacti	Optunia sp.
Grass, couch	Agropyron repens
Grass, Johnson	Sorghum halepense
Grass, Kentucky blue	Poa pratensis
Grass, Northern nut	Cyperus esculentus
Grass, slough	Spartina pectinata
Muhly	Muhlenbergia sobolifera

Group II Tolerant Control with TCA apparently not feasible at dosages of 20 to 100 lb./A.

Bindweed, field	Convolvulus arvensis
Bindweed, hedge	Convolvulus sepium
Creeper, trumpet	Campsis radicans
Dandelion	Taraxacum officinale
Milkweed, whorled	Gonolobus laevis
Spurge, leafy	Euphorbia esula
Spurge, flowering	Euphorbia corollata
Thistle, perennial sow	Sonchus arvensis
Toadflax	Linaria vulgaris
Thistle, Canada	Circium arvense

REACTION OF HERBACEOUS PERENNIAL WEEDS TO CMU

Group I Sensitive Any perennial plant that is controlled by one application of CMU at dosages of 20 to 80 lb./A. More than one treatment often necessary for eradication.

Bindweed, field	Convolvulus arvensis
Bladder campion	Silene vulgaris
Blueweed	Helianthus ciliaris
Chicory	Chicorium intybus
Cress, hoary	Lepidium draba
Dandelion	Taraxacum officinale
Grass, couch	Agropyron repens
Grass, Johnson	Sorghum halepense
Milkweed, whorled	Gonolobus laevis
Motherwort	Leonurus cardiaca
Nimblewill	Muhlenbergia scherberi
Poverty weed	Iva axillaris
Ragweed, bur	Franseria tomentosa
Sage, pasture	Artemisia frigida
Spurge, leafy	Euphorbia esula
Toadflax	Linaria vulgaris
Thistle, Canada	Circium arvense
Thistle, perennial sow	Sonchus arvensis
Dock, curled	Rumex crispus

Group II Tolerant Control with CMU apparently not feasible at dosages of 20 to 80 lb./A.

Horsetail, field	Equisetum arvense
Knapweed, Russian	Centaurea repens
Tanweed	Polygonum coccineum

REACTIONS OF PERENNIAL HERBACEOUS WEEDS TO COMPOUNDS CONTAINING SODIUM CHLORATE

Group I Sensitive Any perennial plant that is controlled by one application of a compound containing sodium chlorate at dosages up to 1600 lb./A active ingredient. Repeated treatments usually necessary for eradication.

Bindweed, field	Convolvulus arvensis
Bracken	Pteris vulgaris
Cress, hoary	Lepidium draba
Grass, couch	Agropyron repens
Grass, Johnson	Sorghum halepense
Knapweed, Russian	Centaurea repens
Ragweed, bur	Franseria tomentosa
Spurge, leafy	Euphorbia esula
Toadflax	Linaria vulgaris
Thistle, Canada	Circium arvense
Thistle, perennial sow	Sonchus arvensis

Group II Tolerant Control apparently not feasible at dosages up to 1600 lb./A active ingredient.

None reported.

REACTION OF PERENNIAL HERBACEOUS WEEDS TO COMPOUNDS CONTAINING BORON

Group I Sensitive Control feasible with compounds containing boron at dosages up to 1600 lb./A. active ingredient. Repeated treatments usually necessary for eradication.

Bindweed, field	Convolvulus arvensis
Grass, Johnson	Sorghum halepense
Knapweed, Russian	Centaurea repens
Ragweed, bur	Franseria tomentosa
Spurge, leafy	Euphorbia esula
Toadflax	Linaria vulgaris

Group II Tolerant Control apparently not feasible at dosages up to 1600 lb./A active ingredient.

Grass, couch	Agropyron repens

OTHER HERBICIDES

MH - perennial species controlled at dosages of 1 to 12 lb./A.

Cockle, white	Lychnis alba
Dock, curled	Rumex crispus
Garlic, wild	Allium vineale
Grass, Johnson	Sorghum halepense

∝∝Dichloropropionic acid - perennial species controlled at dosages of 10 to 35 lb./A.

Grass, couch	Agropyron repens

ANNUAL, WINTER ANNUAL, AND BIENNIAL WEEDS

Summary — R. S. Dunham

Twenty-seven abstracts were received for entry in this section. An additional 31 abstracts reporting results of selective spraying for annual and biennial weeds may be found in the following sections: corn; flax; leguminous forages; mechanical considerations; onions, potatoes, and sweet corn; other vegetable crops; peas and soybeans; spring sown grains; and sugar beets.

A set of 5 abstracts comparing the relative susceptibility of 14 spp. of annual weeds to several formulations of 2,4-D, MCP, and 4C was contributed by Coupland. These trials point out the growing importance of recognizing specificity among herbicides. MCP was more effective on 6 spp. than 2,4-D and 4C was more effective on 8 spp than MCP or 2,4-D when amine formulations were used but in the ester form, 2,4-D was more effective than MCP or 4C on some of the same species. Dunham et al made their second report on response of 50 spp of annuals and biennials to 2,4-D, MCP, and TCA at rates found to be effective in the 1952 trial. In a comparison of MCP and 2,4-D, Wood et al found MCP more effective on hemp nettle than 2,4-D as did Dunham et al. Warren found pre-emergence applications of TCA more effective than CIPC on Setaria lutescens.

Continued interest in control of wild oats by chemicals is manifest in 10 abstracts. Helgeson and Andersen reported the results of very comprehensive tests. In greenhouse trials where the chemicals were mixed with the soil, several carbamates at 16 lb/A controlled both wild oats and Setaria spp but only sunflowers among the crops tried showed tolerance of this rate. Chloral (NP-745) killed both grasses at 16 lb but also killed the crops. CMU and phenyldimethylurea at 2 lb eliminated the grasses but killed the crops. In pre-planting treatments in the field, 12 lb of carbamates gave 94-100% control of wild oats, 12 lb of TCA or 4 lb of CMU gave 91%, and 12 lb of endothal, 60% control. Applications made at the jointing stage of wild oats were generally unsatisfactory, only MH40 showing promise. At 8 lb it prevented heading in nearly all wild oats plants. Endothal applied at various stages and at various rates was most effective (75% control) at 12 lb on wild oats in the seedling stage.

Andersen and Smits found IPC to be most effective on wild oats when applied pre-planting. Pre-emergence and post-emergence applications were unsatisfactory. At a rate of 6 lb/A there was no control of green foxtail by any method. Both pre-emergence and post-emergence applications of TCA gave excellent control of green foxtail but pre-planting was ineffective and no method controlled wild oats. Endothal controlled wild oats 50% and green foxtail and wild mustard regardless of method. In greenhouse trials pre-emergence applications of IPC plus TCA or IPC plus endothal controlled wild oats and green foxtail completely. DNBP at 5 lb, applied pre-emergence, gave 98% control of wild oats for Ebell. He found MH, amine more effective than MH, salt. He observed that barley seedlings seriously injured by contact sprays completely recovered while wild oats appeared unable to make regrowth from the seed. Ebell and Corns reported on TCA for wild oats control.

In studies not reported here, it was found that the rather common method of spraying wild oats that have been drilled into the soil may lead to an optimistic interpretation of results. There may be much less reduction of stand on soils naturally infested with this weed where seeds are found throughout the plow sole. Furthermore, effective rates of the carbamates vary with soil types and other environmental factors.

An abstract by Sexsmith and another by Friesen deal with the effect of additions of nutrient elements to 2,4-D sprays. Addition of N and P increased effectiveness on Russian thistle but addition of N had only a temporary effect on wild buckwheat.

Dalapon was used on foxtail, crabgrass, smartweed, western water hemp, wild oats, green foxtail, and sand-burs in separate trials by Davidson, Wood, and Klingman. It was especially promising on grass weeds. Sand et al reported better results from CMU than TCA or polyborchlorate in the control of weeds on irrigation field laterals. None of these herbicides killed dock or sedge at rates used. Burrows and Olson observed that residual effects of CMU applied in 1951 did not inhibit germination of wild mustard but the seedlings died after food reserves in the seeds had been exhausted. Elder and Dreesen reported satisfactory control of crabgrass using 1 lb/A of CMU, 4-5 lb of CIPC, or 6-8 lb of DNOSBP as pre-emergence sprays if soil moisture was adequate. Keys and Friesen have pointed out that, although early applications of TCA killed foxtail that had emerged, heavy rains in late summer caused a re-infestation from newly germinating seeds. These new plants, however, did not head out.

Abstracts

Effect of different methods of application of IPC, TCA and endothal for control of wild oats, (Avena fatua), green foxtail,(Setaria viridis) and wild mustard (Brassica arvense) in sugar beets, peas and other crop plants. Andersen, E. T. and Smits, O. To simulate field conditions wild oats seed was broadcast and worked in by Rototiller to a depth of 6 in previous to the application of any chemicals. All three chemicals were applied in strips at right angles to strips of weed and crop plants. Pre-planting applications of all three chemicals were made at the following rates in lb/A of active ingredient: IPC - 2, 4, and 6; TCA - 4, 6, and endothal - 6, 8, and 12. Each of these chemicals and rates was worked into two depths, 1 1/2 and 4 inches. A second series of applications were made to the surface at late pre-emergence stage. The following rates in lb/A were used: IPC - 6; TCA - 4, 6, and 8; and endothal - 8, and 12. A third series of applications were made post emergently 25 days after seeding. Sugar beets had 4-5 true leaves and peas were 4-5 in tall. The 3 chemicals were applied at the following rates in lb/A: IPC - 6; TCA - 4, 6, and 8; and endothal - 5 and 10.

Results: IPC was most effective in controlling wild oats when applied as a preplanting treatment and worked into the soil. The depth to which the chemical was worked had little effect on the results, although working into 4 in was less effective at the 4 lb rate than working into 1 1/2 in. The 6 lb treatment gave practically complete control during the first month after application whereas, the 4 lb rate controlled about 80%. Neither the pre-emergence nor post-emergence surface treatments were effective in controlling

Wild oats. Wild mustard was reduced by 20% in the plots receiving the highest rates. Green foxtail and none of the other crop plants were harmed by the IPC at any of the rates.

TCA resulted in excellent control of green foxtail at all three rates when applied post-and pre-emergently. The 8 lb rate completely killed these plants and the lower rates effectively stunted them. No control was obtained when TCA was worked into the soil as a pre-planting treatment. TCA was ineffective against wild oats in all cases. Likewise, it produced no harmful effects on sugar beets, peas, or rape but stunting of corn and sunflowers at the highest rates was noticeable.

Endothal at all rates used and with all methods of application gave nearly 100% control of green foxtail and wild mustard. Wild oats were reduced to a 50% stand. Sugar beets and corn were retarded in development at the highest rates of pre-and post-emergent applications by 3-7 days. Pre-planting and pre-emergence treatments caused destruction of 75-85% of peas, soybeans, rape and sunflowers. Post-emergent treatments were only slightly less harmful to these crops at the rates used. (Contribution of the Division of Plant Science, University of Manitoba. Approved for publication.)

Effect of Combining IPC and TCA, and IPC and endothal in successive treatments for control of wild oats (Avena fatua) and green foxtail (Setaria viridis) in sugar beets and peas. Andersen, E. T. and Smits, O. The study was carried out in the greenhouse by planting one row each of sugar beets, peas, green foxtail, and wild oats in regular plant flats. Just previous to emergence of any of the plants, IPC at 8 lb/A followed by TCA at 6 lb was applied as one treatment. Another set of flats received IPC at 8 lb followed by endothal at 4 lb.

Results: Both of these chemical combinations resulted in complete control of wild oats and green foxtail. The IPC-TCA combination produced no noticeable harmful effects on the sugar beets and only slight stunting of the peas. The IPC-endothal combination produced no noticeable effects on sugar beets but severely stunted the peas. Separate treatments of IPC alone controlled wild oats with no injury to the other 3 plant species. TCA alone completely controlled green foxtail with little injury to the other plants. Endothal alone caused stunting of peas, green foxtail, and wild oats with little effect on sugar beets. (Contribution of Division of Plant Science, University of Manitoba. Approved for publication.)

Control of wild oats and Setaria with endothal. Andersen, R. N. and Helgeson, E. A. Wild oats was drilled in Fargo clay soil at approximately 2 bu/A on May 25, 1953. A split-plot design with 6 replications was employed with stage of growth as main plots and rates of application as subplots. Disodium 3,6,endoxohexahydrophthalate (endothal) was applied in 40 gal of aqueous solution at 0, 2, 4, 6, 8, and 12 lb/A when the wild oats was in the seedling, tillering, jointing, and boot stage. A naturally occurring stand of Setaria lutescens emerged before the wild oats tillered. Poorer control of wild oats was obtained than in previous years at this location. Control was determined on the basis of dry weight of shoots produced 6 weeks after treatment.

Results: Treatments in the seedling stage (1-2 leaf stage) gave the best control. However, 12 lb of endothal was necessary to obtain only 75% control in that stage while 2, 4, 6, and 8 lb gave 40, 50, 54, and 65% control respectively. Treatments at the other three stages were less effective with control being proportional to the rate of application. Good control of Setaria was obtained with only 2 lb of endothal at the second and third date of spraying. (Division of Weed Invest. B.P.I.S.A.E., U.S.D.A. and North Dakota Agr. Exp. Sta. Approved for publication.)

Greenhouse trials with various herbicides in pre-planting treatments. Andersen, R. N. and Helgeson, E.A. IPC, CIPC, Isopropyl N-(3-Methylphenyl)-carbamate (T-516), Sec. Butyl N-(3-Chlorophenyl)-carbamate (T-517), Isopropyl N-(2 methoxy-5-chlorophenyl)-carbamate (T-518), CMU, Phenyldimethylurea (Cpd. 2049), and Chloral (NP-745) were stirred into soil in duplicate flats at the rate of 0, 2, and 16 lb of active material/A calculated on the surface area of the flat. Setaria and wild oat seeds were mixed throughout the flat.

Results: IPC, CIPC, and T-516 at 2 lb gave 98-100% control of wild oats. The 2 lb rate was much less effective in controlling Setaria. At 16 lb these carbamates gave 100% control of wild oats and excellent control of Setaria. Sunflowers were injured little if any at both 2 and 16 lb/A, soybeans only slightly at 2 but severely at 16 lb, corn severely at both rates. T-517 at 2 lb gave72 and 5% control of wild oats and Setaria, respectively, with little if any injury to crops. At 16 lb it gave 100% control of both species with severe injury to all three crops. T-518 gave no control of either weed at 2 lb. At 16 lb it gave99 and 38% control of wild oats and Setaria, respectively, while injuring sunflower slightly, corn and soybeans moderately. CMU and Cpd. 2049 were similar in action. Both gave little or no control at first, but later both chemicals at both rates gave complete control of the weedy grasses and very severe injury or complete elimination of all three crops. At 2 lb NP-745 gave 62 and 99% control of wild oats and Setaria respectively. At 16 lb it gave 100% control of both. All crops were injured badly by both rates. However, sunflower showed some tolerance to the 2 lb rate. (Division of Weed Invest. B.P.I.S.A.E., U.S.D.A., and North Dakota Agr. Exp. Sta. Approved for publication.)

Soil sterility of CMU, 1953. Burrows, V. D. and Olson, P. J. This experiment was conducted on plots treated with CMU at 25, 50, and 100 lb active ingredient/A in 1951 and 5 and 15 lb active ingredients/A in 1952 (Research Report 1952 .43). One row of wild mustard, radish, sweet clover, alfalfa, wheat, barley, flax, sunflowers and soybeans was sown in each plot. Germination was excellent. After the seedlings had exhausted the foos reserves in their seeds and began feeding on the soil, they died in all the treated plots.

Results: Canada thistle was found on all plots and was rated on the basis of vigor as healthy (0, 5, 15, 25 lb), poor (50 lb) and very poor (100 lb). Sow thistle was found on all plots except those treated with the 50 and 100 lb rates. In so far as crop plants are concerned, it is evident that the rates of CMU used in this experiment have sterilized the soil for periods of 2 years (5, 15 lb) and 3 years (25, 50, 100 lb). (Contribution from Division of Plant Science, The University of Manitoba).

Relative susceptibility of annual weeds to amines of three herbicides. Coupland, R. T. Fourteen species of annual weeds were treated in triplicate with amines of 2,4-D, MCP, and 4-chlorophenoxyacetic acid (4-C) at 4, 8, and 16 oz/A in three stages of development. The weeds were sown in rows 2 ft apart on May 5 and 6 at Saskatoon. Emergence took place from May 25 to June 7. First treatment - June 8, weeds 0.25 to 2.5 in high; second treatment - June 19, weeds 1-4 in high. Third treatment - June 30, 1-16 in high. Three species were beginning to flower at the last stage of treatment. The weeds reacted as follows to each herbicide (in order from most sensitive to most tolerant). (Underlining indicates the most effective control of each species and the numbers in parenthesis represent the most effective stage of treatment. "T" indicates tolerance).

2,4-D	MCP	4-C
Tumbling mustard (3)	Wild mustard (1)	Tumbling mustard (3)
Russian pigweed (1)	Stinkweed (1)	Shepherd's purse (3)
Wild mustard (2)	Tumbling mustard (1)	Flixweed (3)
Hare's ear mustard (2)	Russian pigweed (1,3)	Russian pigweed (1)
Flixweed (2)	Flixweed (2)	Wild mustard (1)
Stinkweed (2)	Hare's ear mustard (2)	Stinkweed (2)
Russian thistle (2)	Shepherd's purse (2)	Hare's ear mustard (2)
Red root pigweed (3)	Night-fl. catchfly (2)	Russian thistle (3)
Shepherd's purse (2)	Cow cockle (1)	Red root pigweed (2)
Tartary buckwheat (1)	Russian thistle (1)	Blue bur (3)
Cow cockle (T)	Red root pigweed (2)	Tartary buckwheat (3)
Night-fl. catchfly (T)	Purple cockle (2)	Cow cockle (2)
Blue bur (T)	Tartary buckwheat (1,2,3)	Night-fl. catchfly (1)
Purple cockle (T)	Blue bur (2)	Purple cockle (3)

(Contribution from the Dept. of Plant Ecology, Univ. of Sask., Saskatoon. Approved for publication.)

Relative susceptibility of annual weeds to esters of three herbicides. Coup land, R. T. Fourteen species of annual weeds were treated in triplicate with butoxy ethanol esters of 2,4-D, MCP and 4-chlorophenoxyacetic acid (4-C) at 4, 8, and 16 oz/A in three stages of development. The weeds were sown in rows 2 ft apart on May 5 and 6 at Saskatoon. Emergence took place from May 25 to June 7. First treatment - June 8, weeds 0.25 to 2.5 in high; second treatment - June19, weeds 1-4 in in height; third treatment - June 30, 1-16 in high. Three species were beginning to flower at the last stage of treatment. The weeds reacted as follows to each herbicide (in order from most sensitive to most tolerant). (Underlining indicates the most effective control of each species and the numbers in parenthesis represent the most effective stage of treatment.)

2,4-D	MCP	4-C
Russian pigweed (1)	Tumbling mustard (2)	Tumbling mustard (2)
Wild mustard (1)	Wild mustard (1)	Wild mustard (2)
Tumbling mustard (2)	Hare's ear mustard (2)	Russian pigweed (1)
Stinkweed (1)	Russian pigweed (2)	Hare's ear mustard (3)
Shepherd's purse (2)	Flixweed (2)	Stinkweed (1)
Flixweed (2)	Stinkweed (1)	Russian thistle (2)
Hare's ear mustard (1)	Tartary buckwheat (1)	Flixweed (3)
Russian thistle (1)	Red root pigweed (1)	Red root pigweed (2)
Blue bur (1)	Blue bur (2)	Purple cockle (1)
Cow cockle (1)	Shepherd's purse (1)	Cow cockle (1)
Red root pigweed (1)	Purple cockle (3)	Shepherd's purse (2)
Tartary buckwheat (3)	Russian thistle (3)	Tartary buckwheat (1)
Purple cockle (2)	Night-fl. catchfly (1)	Night-fl. catchfly (1)
Night-fl. catchfly (1)	Cow cockle (1)	Blue bur (1)

(Contribution from the Dept. of Plant Ecology, Univ. of Sask., Saskatoon. Approved for publication.)

Comparative susceptibility of annual weeds to 2,4-D and MCP, 1953. Coupland, R. T. Fourteen species of annual weeds were treated in triplicate with alkanolamines of 2,4-D and MCP and butoxy ethanol esters of 2,4-D and MCP at 4, 8, and 16 oz of acid/A in three stages of development of the weeds. The weeds were sown in rows 2 ft apart on May 5 and 6 at Saskatoon. Emergence took place from May 25 to June 7. First treatment - June 8, weeds 0.25 to 2.5 in high; second treatment - June 19, weeds 1-4 in in height; third treatment - June 30, 1-16 in high. Three species were beginning to flower at the last stage of treatment.

Results: Seven species were more susceptible to both ester and amine formulations of MCP than to the corresponding formulation of 2,4-D. These were (in order beginning with greatest difference in susceptibility) wild mustard, flixweed, night-flowering catchfly, hare's ear mustard, purple cockle, tartary buckwheat and blue bur. Shepherd's purse, stinkweed, and Russian pigweed were more susceptible to the amine of MCP than to the amine of 2,4-D but less susceptible to the ester of MCP than to the ester of 2,4-D. Russian thistle was more susceptible to 2,4-D in the ester form than to MCP but no difference was noted between the amines. Cow cockle was more susceptible to MCP amine than to 2,4-D amine but reacted similarly to the esters. Red root pigweed and tumbling mustard were more sensitive to MCP in the ester form than to 2,4-D but these species reacted similarly to the two amines. (Contribution of the Dept. of Plant Ecology, Univ. of Sask., Saskatoon. Approved for publication.)

Comparative susceptibility of annual weeds to MCP and 4-chlorophenoxyacetic acid. Coupland, R. T. Fourteen species of annual weeds were treated in triplicate with amines of MCP and 4-chlorophenoxyacetic acid (4-C) and with butoxy ethanol esters of MCP and 4-C at 4, 8, and 16 oz of acid/A in three stages of development of the weeds. The weeds were sown in rows 2 ft apart on May 5 and 6 at Saskatoon. Emergence took place from May 25 to June 7. First treatment - June 8, weeds 0.25 to 2.5 in high; second treatment - June 19, weeds 1-4 in in height; third treatment - June 30, 1-16 in high. Three species were beginning to flower at the last stage of treatment.

Results: Stinkweed and wild mustard were more susceptible to both formulations of MCP than to the corresponding formulation of 4-C, while Russian thistle and cow cockle were more susceptible to both formulations of 4-C than to the corresponding MCP formulation. Five species were more susceptible to MCP in the ester form than to 4-C but they were more susceptible to 4-C as an amine than to MCP. These are flixweed, tumbling mustard, blue bur, red root pigweed and tartary buckwheat. Russian pigweed and purple cockle were more susceptible to MCP than to 4-C in the amine form but reacted similarly to the esters of both herbicides. Hare's ear mustard was more sensitive to MCP in the ester form but no difference was found in the reaction to the two esters. Night-flowering catchfly was more sensitive to the 4-C as an ester, but reacted similarly to both amines. Shepherd's purse reacted similarly to both herbicides. (Contribution from the Dept. of Plant Ecology, Univ. of Sask., Saskatoon. Approved for publication.)

Comparative susceptibility of annual weeds to 2,4-D and 4-chlorophenoxyacetic acid. Coupland, R. T. Fourteen species of annual weeds were treated in triplicate with amines of 2,4-D and 4-chlorophenoxyacetic acid (4-C) and butoxy ethanol esters of 2,4-D and 4-chlorophenoxyacetic acid at 4, 8 and 16 oz of acid/A in three stages of development of the weeds. The weeds were sown in rows 2 ft apart on May 5 and 6 at Saskatoon. Emergence took place from May 25 to June 7. First treatment - June 8, weeds 0.25 to 2.5 in high; second treatment - June 19, weeds 1-4 in. in height; third treatment - June 30, 1-16 in high. Three species were beginning to flower at the last stage of treatment.

Results: Five species were more susceptible to 4-C in both ester and amine forms than to the corresponding formulations of 2,4-D. These were hare's ear mustard, purple cockle, tartary buckwheat, night-flowering catchfly and red root pigweed. Cow cockle and tumbling mustard responded more to 4-C than 2,4-D as amines but no difference was observed with respect to susceptibility between the esters. Wild mustard was more susceptible to the 2,4-D amine than to the 4-C amine but no difference occurred in response to the two esters. Russian pigweed was more susceptible to 2,4-D ester than to 4-C ester but reacted similarly to both amines. Five species were more susceptible to 4-C in the amine form and 2,4-D in the ester form. These were shepherd's purse, Russian thistle, flixweed, stinkweed and blue bur. All species were more susceptible to ester of 2,4-D than amine of 2,4-D, but shepherd's purse and flixweed reacted more to the amine of 4-C than the ester of 4-C. Tartary buckwheat was more susceptible to 4-C amine than to 2,4-D ester, while all other species reacted as much or more to 2,4-D ester. (Contribution of the Dept. of Plant Ecology, Univ. of Sask., Saskatoon. Approved for publication.)

Dalapon for the control of sandburs (Cenchrus pauciflorus). Davidson, J. H. Applications of Dalapon, sodium salt, with wetting agent at rates of 3, 5, 10, 20 and 40 pounds technical acid equivalent/A were applied for the control of sandburs. Applications were made with a knapsack sprayer at the rate of 40 gal of spray/A on July 9, 1953. At this time the sandbur leaves were 2-3 in long. Seed stalks had not formed. Counts of live sandbur plants on August 31, 1953 from the 3, 5, 10, 20 and 40 lb/A treatments showed an average of 58, 9, 10, 2 and 2.5 plants respectively per 3 sq ft area. Untreated 3 sq ft areas averaged 81 live plants. Rainfall was 0.5 in, July 17, 0.18 in, July 18, and .81 in on July 22. A later application at the same rates as above but applied after the seed stalks had formed and the burs were present was much less effective. (Contribution of the Dow Chemical Company, South Haven, Mich. Approved for publication.)

Response of weed species to 2,4-D, MCP, and TCA. Dunham, R. S., Wiese, A. F., Rachie, K. O., and Anderson, L. E. 2,4-D and MCP amines were applied to separate plots of each species at a practical stage for spraying. Rates varied from 3-8 oz/A depending on tolerance shown in the 1952 trial.

At the 3 oz rate, the following species were killed by both herbicides: Brassica kaber, Sisymbrium altissimum, Raphanus raphanistrum, Ipomoea spp. Brassica juncea was badly stunted and produced very little seed. At the 4 oz rate Iva xanthifolia, Lepidium virginicum, Vicia spp., Ambrosia trifida, and Tragopogon pratensis. At the 6 oz rate Xanthium spp., Kochia scoparia, Chenopodium album, Capsella bursa-pastoris, Conringia orientalis, Chenopodium hybridum, Erysimum choiranthoides, Helianthus annuus, Thlaspi arvense, Dracocephanlum parviflorum, Daucus carota, and Berteroa incana. At the 8 oz rate, Silene latifolia.

At the 6 oz rate the following were resistant or produced seed: Cannabis sativa, Asclepias syriaca, Amaranthus retroflexus, Rumex acetosella, Cuscuta spp., Solanum carolinense, Abultilon theophrasti, Amaranthus blitoides, Datura stramonium, and Portulaca oleracea. At the 8 oz rate, Arctium minus, Spergula arvensis, Lychnis alba, Malva rotundifolia, Hibiscus trionum, Silene noctiflora, Polygonum convolvulus, Solanum rostratum, Solanum nigrum and Polygonum pennsylvanicum. Galeopsis tetrahit was killed by MCP but was resistant to 2,4-D.

At 5 lb/A, TCA, sodium, killed the following species: Setaria faberi, Setaria viridis, Setaria glauca, and Echinochloa crusgalli. Avena fatua and Avena sativa were resistant. TCA, butyl ester, was less effective than the sodium salt on every species. (Contribution from the Department of Agronomy & Plant Genetics, University of Minnesota; St. Paul, Minn. Paper No. 3078 Sci. Jour. Series, Minn. Agric. Exp. Station. Approved for publication by the Experiment Station Director.)

Effect of TCA on wild oats and various crops following fall and spring application. Ebell, L. R. and W. G. Corns. On October 9, 1952, a disked area was sown to wild oats. The area received the following treatments: 40 lb/A of TCA on October 10, 1952; 50 lb/A of TCA on May 11, 1953; untreated check. Crops were sown at right angles to part of the treated area as follows: wheat, oats, barley, fall rye, sown May 7; flax sown June 8; late barley sown June 20. Four sq yd samples were taken on August 14 and plant count and green weight data obtained for the wild oats and crops concerned.

Results: No wild oat growth occurred in the fall, but germination in the spring was so complete that adequate seed samples could not be obtained to determine treatment effect on seed viability. Fall treatment reduced the pure wild oat stand by 72% as contrasted to 45% from the spring application. The late sown barley was more seriously affected by the spring application, whereas early sown crops proved more susceptible to the fall application and could be arranged in decreasing order of tolerance as follows: flax, oats, rye, barley and wheat. Cultivated oats and wild oats showed a very similar response to TCA. No effect could be noted on fall rye planted September 21, 1953. (Contributed by the Department of Plant Science, University of Alberta, Edmonton, Alberta. Approved for publication.)

Residual effect of TCA on wild oats and wheat following fall application. Ebell, L. F. and W. G. Corns. Application of TCA was made September 21, 1952 on wild oats planted previously. Plots were of sufficient width to permit planting of various crops throughout the summer of 1953. Data were obtained on seedling emergence at the 2-3 leaf stage; on forage wt of wild oats taken at advanced flowering stage, and of wheat at maturity. Samples consisted of two 1/2 rod rows. The data in the table are the average of four replicates:

	Check *	Per Cent of Check					
		5 lb/A	10 lb	20 lb	40 lb	80 lb	LSD
Wild oats - Planted Sept. 1952							
Fall emergence	173	88.2	68.2	51.3	47.6	23.8	37.2
Spring emergence	73	77.7	60.3	54.5	34.6	4.4	36.9
Forage wt	4.04	77.0	32.4	14.1	3.2	1.0	51.5
Panicle count	259	74.5	24.0	13.6	1.9	0.0	25.1
Wild oats - Planted June 15,1953							
Forage wt	3.80	100.0	100.5	72.1	47.4	41.0	25.3
Wheat - Planted May 7, 1953							
Emergence	218	84.9	79.4	61.8	66.7	34.5	22.1
Forage wt	3.00	27.7	0.3	0.0	0.0	0.0	27.0

* All figures in check column expressed in original units, actual count or wt in kilograms.

Flax planted June 26, 1953, was inadvertently destroyed before yield data could be taken, but observations indicated serious damage at the 40 and 80 lb rates. No adverse effect could be noted on fall rye seedlings planted September 22, 1953. These data indicate that residual effect persisted into mid-summer following fall application. Emergence from wild oat seeds in contact with the soil over the winter appeared to be markedly reduced compared with number of seedlings appearing in the fall. Germination and forage yield data on spring seeded wheat indicated the extreme sensitivity of this crop to even minute quantities of TCA remaining in the soil. (Contributed by the Department of Plant Science, University of Alberta, Edmonton, Alberta. Approved for publication.)

Contact pre-emergence control of wild oats. Ebell, L. F. Chemical application was made on June 6, 1953, to rows of wild oats in the 2-3 leaf stage. Chemicals and rates used were: DNBP in 20 gal diesel oil; PCP; IPC; CIPC; MH amine; MH salt; Alpha-Cyano-beta-(2-4-dichlorophenyl)acrylic acid (one half of plot sprayed with amine, the other half with ester); at 2.5, 5, and 10 lb/A, endothal at 5, 10, and 20 lb/A, high aromatic content coal tar derivative (Crag herb #3) at 5, 10, and 20 gal/A, Aromatic oil at 10, 20 and 40 gal/A. Green weight data at advanced flowering stage were taken July 30.

Results: Only the DNBP was effective at the low rate and gave 98-100% control at rates II and III. MH amine and endothal gave 70 and 57% control respectively at rate II. At the high rate, the following chemicals, arranged in decreasing order of effectiveness, significantly reduced forage yield: DNBP; MH amine; endothal; aromatic oil; CIPC; IPC; Crag herb #3; PCP; MH salt. The highly significant difference in action of the MH formulations is noteworthy (81% control with the amine contrasted with 53% for the salt). Neither the amine nor ester of alpha-cyano-beta (2,4-dichlorophenyl) acrylic acid showed significant growth-depressing effect. A single row of wheat planted to emerge one day after chemical application showed no injury except from CIPC and IPC.

A second experiment was laid down on June 16 on an infested farm field with barley drilled directly into a wild oat growth. Chemicals used were DNBP, 5 and 10 lb/A with 20 gal diesel oil; DNBP, 5 and 10 lb/A with 5 gal diesel oil plus water; aromatic oil, 20 and 40 gal/A; Crag herb #3, 20 and 40 gal/A; and MH salt at 4 and 8 lb/A.

Results: A wild oat count made on August 10 showed significant reductions for all chemicals and rates except for the MH salt. The Crag herb #3 and aromatic oil gave comparable reductions of 94 and 91% respectively at the high rates. The DNBP at the 5 lb rates gave comparable reductions of 70 and 75% for the low and high volumes of oil respectively, whereas the high volume of oil more than doubled the effectiveness of the 2.5 lb rate. The barley had emerged the day before treatment and seedlings were seriously damaged; however, regrowth occurred from the seed, resulting in subsequent crop recovery. This characteristic may help to facilitate contact pre-emergence control since wild oats do not appear to have this power of regrowth from the seed. (Contributed by the Department of Plant Science, University of Alberta, Edmonton, Alberta. Approved for publication.)

Effect of soil sterilants and seedling toxicants on wild oats. Ebell, L. F. and W. G. Corns. The following chemicals were applied on May 14, 1953, two days after seeding wild oats. Dichloral urea; SES; Bis (dichloro) phenoxyethyl oxalate; N-1 napthyl phthalamic acid; IPC; CIPC; CMU; and IPC and CIPC disked into the soil, were applied at 5, 10, and 20 lb/A. TCA was applied at 12.5, 25, and 50 lb/A. Data of green weight at the advanced flowering stage were taken July 27, and analyzed statistically with the following results:

Results: Low rates of all chemicals were ineffective. Only CIPC (undisked) significantly reduced yield at rate II. At the high rates the following chemicals, arranged in decreasing order of effectiveness, significantly reduced forage yield: IPC; CIPC; CMU; CIPC disked; IPC disked, and TCA. Disking did not significantly reduce efficiency of IPC and CIPC but some reduction was indicated by trend, especially with IPC. 2,4,5-trichlorophenoxyethyl sulphate was obtained later and applied at comparable rates on May 24 (one day before emergence) with no apparent effect on wild oats. Poor herbicidal action in this experiment may be attributed to a long dry period at time of application, whereas, the soil at seed depth contained an adequate moisture supply for vigorous wild oat growth. (Contributed by the Department of Plant Science, University of Alberta, Edmonton, Alberta. Approved for publication.)

Pre-emergence treatments for control of crabgrass. Elder, W. C. and Jack Dreessen. Pre-emergence sprays of CIPC, CMU and UNOSEP were applied in different concentrations on several crops immediately after planting. Treatments were made several days apart, consequently moisture conditions of the soil varied. Rainfall and weather conditions affected results materially. Good crabgrass control was secured from treatments made immediately before rains. One test was made on soil prepared and planted soon after a rain. Considerable crabgrass germinated after planting that was not destroyed by the herbicides. Poor results were probably due to high temperatures at time of treatments and the dry weather that followed. In this test the crabgrass made rapid growth and was 2 or 3 inches high before rains came 24 days after planting.

Results: After the rains the higher concentrations of some herbicides killed the grass without injury to the crop, however, the rates usually recommended for crabgrass were complete failures. It appears from this test that the chemicals never reach the soil solution when applied on a surface soil that dries out rapidly. If the seedbed preparation in this test had been delayed one day the crabgrass would have been destroyed until the next rain. Under good soil moisture conditions 1 lb/A of CMU, 4-5 lb/A CIPC and 6-8 lb/A DNOSBP gave satisfactory control of crabgrass as pre-emergence sprays. CIPC is less injurious to crops than the other chemicals at the above rates. Cotton seems more resistant to CMU than most field crops, however, peanuts are severely injured by low rates of CMU. (Contribution of the Agronomy Department, Oklahoma Experiment Station, Stillwater, Oklahoma.)

The effect of herbicides on wild buckwheat. Friesen, H. A. In 1953, CIPC, MH, TCA, IPC and CMU were each sprayed at 4 lb/A in 80 gal/A of water on wild buckwheat in wheat. The buckwheat was mostly in the cotyledon stage, and the wheat had 2 leaves at the time of spraying. In addition, a 2,4-D ester and amine, a low volatile ester, (LV-4) and an MCP ester, amine and sodium salt were each sprayed at 1/4 and 1/2 lb/A in 4 gal of water/A at this time.

Results: The CIPC, IPC and MH had very little effect on the buckwheat but very materially reduced the yield of the wheat. TCA stunted but did not kill the weed, however, it killed 70 per cent of the wheat. Due to the early date of treatment there was further emergence of buckwheat and each of these plots carried a heavier infestation after the above treatments than it did before. CMU resulted in 80 per cent of the buckwheat being killed and the remaining plants very severely stunted. The wheat was delayed and the yield slightly depressed. The 2,4-D ester at 1/2 lb/A and the low volatile ester at 1/4 and 1/2 lb/A killed 42, 50, and 66% of the buckwheat plants, respectively; the 2,4-D ester at 1/4 lb/A and the MCP treatments stunted the weed but did not kill it. The 2,4-D, MCP and LV-4 treatments did not materially influence the yield of wheat.

A 2,4-D ester and amine, an MCP ester, amine and sodium salt and (LV-4) were each sprayed at 1/4 and 1/2 lb/A on wild buckwheat in wheat. The buckwheat had 4-6 true leaves at the time of spraying. Each of the treatments halted the growth of the buckwheat for some 2-3 weeks.

Results: The actual plant kills however, were unsatisfactory. LV-4 and the 2,4-D ester resulted in kills of 45 and 30%, respectively and the surviving plants recovered rather slowly. The remaining treatments markedly suppressed the growth but nearly all of the plants recovered and produced seeds.

2,4-D ester and amine and LV-4 were sprayed on wild buckwheat just prior to vining at the rate of 1/4 lb/A with and without the addition of nitrogen to the water carrier. The soluble nitrogen was obtained from commercial fertilizers and varied in amount from 1/3 to 5 lb of nitrogen/A.

Results: The immediate effects of the 2,4-D and nitrogen mixtures were very striking. The buckwheat plants wilted 2 days after treatment, the branches were much thickened and the roots showed heavy lesions. However, 20 days after treatment the number of dead plants was negligible and the survivors had begun to vine and flower, much the same as in plots treated with 2,4-D alone. The

LV-4 and nitrogen mixture followed a similar trend except that the number of plants killed was slightly higher. Spraying the buckwheat with 1-7 gal. of 5-10-5 liquid fertilizer prior to spraying with 2,4-D ester and LV-4 at 1/4 and 1/2 lb/A similarly did not improve the control. 2,4-D ester and LV-4 at dosages of 1/4, 1/2 and 3/4 lb/A after the buckwheat had begun vining did not result in satisfactory kill or control of this weed. Wild buckwheat which had previously been sprayed during 4-leaf stage with 2,4-D ester at 1/4 lb/A was re-sprayed some 2 weeks later with 2,4-D ester and LV-4 each at 1/4 and 1/2 lb /A. While none of the treatments resulted in complete kills the buckwheat was prevented from vining and flowering. This has been the most promising treatment tried to date. (Contributed by the Dominion Experimental Station, Scott, Sask. Approved for publication.)

Pre-planting treatments for control of wild oats. Helgeson, E. A., and Andersen, R. N. Randomized duplicate plots were laid out on Fargo clay which had been drilled to wild oats on May 25, 1953. Chemicals were applied May 26, in 40 gal aqueous solution/A. The plots were immediately disked twice with a tandem disk to a depth of approx. 3 in. and then were harrowed. Crops were planted May 27. Chemicals were sodium salt of TCA, CIPC, IPC, endothal, Isopropyl N-(3-Methylphenyl)-carbamate (T-516), and Sec.-Butyl N-(3-chlorophenyl)-carbamate (T-517) at the rate of 2 and 12 lb active material/A. CMU and phenyldimethylurea (Cpd. 2049) were applied at 1/2 and 4 lb/A.

Results: Only the higher rate of any chemical gave effective control of the wild oats as estimated 28 days after treatment. The chemicals (higher rate) in order of their effectiveness were CIPC 100%, T-516 100%, IPC 99%, Cpd. 2049 99%, T-517 94%, CMU 91%, TCA 91%, and endothal 60%. Sugar beets showed some tolerance to the higher rate of all the chemicals except CMU, Cpd. 2049, and CIPC. Flax was severely injured or completely eliminated by the higher rate of all materials except TCA which gave moderate injury. Corn was severely injured or completely eliminated by the higher rate of all materials. Soybeans showed tolerance to the high rate of IPC but considerable injury from all the other materials. Sunflower tolerated the higher rate of IPC, CIPC, and T-516, but was injured moderately to severely by the other materials. (Contributed by the North Dakota Agr. Exp. Sta. and Div. of Weed Invest. B.P.I.S.A.E., U.S.D.A. Approved for publication by the Experiment Station Director.)

Effect of various herbicides on wild oats. Helgeson, E. A., and Andersen, R. N. Ten herbicides were applied at the rate of 2 and 8 lb of active material/A to wild oats which was in the jointing stage (9-12 in tall) on July 3, 1953. All materials were applied in 40 gal of aqueous mixture/A to randomized duplicate plots. Notes on control were taken August 11, 1953.

Results: The following chemicals gave no apparent control at either rate: dichloral urea (EH-2), hexachloroacetone (Cpd. 1106), trichloroacetylurea (Cpd. 2015), trichloroacetanilide (Cpd. 2025), sodium trichloroacrylate (E. C. 3890), N-1 naphthyl phthalamic acid (alanap 1), and sodium salt of TCA. Disodium 3,6, endoxohexahydrophthalate (endothal) and a,a-dichloropropionic acid (dalapon) gave no apparent control of wild oats at 2 lb but gave a moderate reduction in panicle production at 8 lb. Sodium salt of maleic hydrazide (MH-40) at 2 lb stunted the wild oats slightly and reduced panicle production considerably. At 8 lb MH-40 gave good control of the wild oats, the vegetation in those plots being 9 in tall compared to 30 in. in the check. MH-40 at 8 lb prevented heading in all but a very few plants. (North Dakota Agr. Exp. Sta. and Div. of Weed Invest. B.P.I.S.A.E., U.S.D.A. Approved for publication by the Experiment Station Director.)

Effect of TCA on green foxtail (Setaria spp.) Keys, C. H. and Friesen, H. A. TCA at 0, 4, 6, 8 and 12 lb/A was mixed with 240 gal/A of water and sprayed on green foxtail in Dakota flax. The foxtail was mostly in the 3-leaf stage and the flax in the 6-8 leaf stage of growth at the time of spraying.

Results: Each of the TCA treatments killed those foxtail plants which had emerged at the time of spraying. The herbicidal action was rather slow in that 4-6 weeks had elapsed until the last plants had died. Heavy rains in late summer caused the plots to be re-infested with foxtail. The degree of re-infestation on the plots treated with 4, 6, 8 and 12 lb/A was 25, 18, 10 and 5 per cent of the original stand, respectively. These new plants however, were very severely stunted and none of them advanced to the heading stage, whereas the untreated plants on the check plots produced a very heavy crop of seed. The field appearance and yield of the treated flax was the same as the untreated flax notwithstanding that the stand of foxtail at the time of spraying was some 600 plants/sq.yd. (Contributed by the Dominion Experimental Station, Scott, Sask. Approved for publication.)

Preliminary trials with dalapon on weedy annual grasses. Klingman, Dayton L. Sodium salt of a,a-dichloropropionic acid (dalapon) was applied as a directed spray July 1st, 1953 to established plants of foxtail and crabgrass in rows of soybeans at rates of 2, 3, 4, 5, 6 and 8 lb/A.

Results: By July 30, most of the weedy grass plants treated with 5, 6, and 8 lb/A were dead. The other rates gave 30% or less weedy grasses killed; however, many of the plants still living in the lighter dosage plots continued to deteriorate and by the end of August satisfactory control was obtained at all rates. While only the stems and lower leaves of soybeans were contacted with the dalapon, the soybean plants were severely stunted, and at rates of 4 lb and less, tremendous over- production of flowers at the nodes was evident. As many as 100 flowers per node were found on some plants. Large plants of smartweed and western water hemp were also stunted but not killed. (Contribution of the Division of Weed Investigations, BPIS&AE, U. S. Department of Agriculture and the Missouri Agricultural Experiment Station cooperating. Approved for publication.)

Control of weeds on irrigation field laterals. Sand, P. F., Furrer, J. D. and May, W. P. Duplicate plots 25 ft long and 8 ft wide were treated with CMU at rates of 5, 10, 20, 40, 80, and 120 lb/A, TCA at 20 and 40 lb/A on June 12, 1952, in Scottsbluff County on Mitchell silt loam. One set of plots was on a field lateral that had just been repaired and had foxtail, kochia, pigweed, and wild buckwheat 2-4 in tall with small amounts of sedge and dock. Another set of plots was on an irrigation ditch with a rank growth of sedge 12-18 in tall with small amounts of bluegrass, smooth brome, and muhlenbergia. The plots were flooded by a heavy rain shortly after application of chemical. The farmer also made minor repairs on the field lateral throughout the season.

Results: Notes taken July 12, 1952, showed CMU at 5, 10, 20, 40, 80, and 120 lb/A gave 70, 95, 95, 95, 95, and 98 per cent control of annual weeds, however, control remained about the same the entire season. TCA at 20 and 40 lb gave 30 and 50% control. Notes taken September 24, 1953, showed no control of sedge was obtained with any treatments except the 120 lb of CMU/A, however, muhlenbergia survived at that rate.

On April 6, 1953, CMU and phenyldimethylurea at rates of 5, 10, 20, and 40 lb/A and polybor chlorate at 6 and 10 lb/sq rod were applied to a field lateral in Scottsbluff County on Mitchell silt loam. The plots were the same size as in the 1952 test with two replications except for polybor chlorate which had only one replication. Downy brome 1 in. tall and kochia 1/2 in. tall were emerged at the time of treatmant. Shortly after the chemicals were applied, a 4-in rain flooded the area and broke the ditch in several places. A treatment with 10, 20, 30, and 40 lb of CMU was applied to another area of the same ditch June 11, 1953, That had just been cleaned out and had kochia and dock 1-2 in tall at the time of application. All chemicals used carried out in the field 6-8 ft but no damage to sugar beets or potatoes was noted beyond that point.

Results: Estimates of per cent control made September 24, 1953, on control of annual weeds of the April 6, 1953, treatments showed CMU at 5, 10, 20, and 40 lb/A gave 83, 91, 99, and 100% control; phenyldimethylurea at 5, 10, 20, and 40 lb/A gave 70, 90, 97, and 97% control, and polybor chlorate at 6 and 10 lb/sq rod gave 85 and 80% control of annual weeds. Estimates of control of annual weeds from the June 11, 1953, with CMU were also made September 24, 1953. CMU at 10, 20, 30, and 40 lb/A all gave 100% control of annual weeds. Dock and sedge were not controlled by any of the rates used in the 1953 test, however, they did appear to be stunted. (Contribution of Department of Agronomy, University of Nebraska Extension Service and State Division of Noxious Weeds.)

Nutrient element additions to 2,4-D sprays. Sexsmith, J. J. Tests conducted in 1952 demonstrated the superior control of Russian thistle resulting from fertilizer additions to amine 2,4-D sprays. The increased degree of curling down of the weeds was equal for additions of ammonium phosphate (11-48-0) supplying either 2 1/2 oz or 10 lb nitrogen/A, and ammonium phosphate was considerably better than the organic nitrogen additions supplied by urea. Additions of metallic salts reduced the effectiveness of the amine 2,4-D treatments, except when the mixture also contained ammonium phosphate.

In the 1953 test, analytical grade chemicals and distilled water were used to make up spray solutions buffered at pH 5, and standard rate of 4 oz acid equivalent 2,4-D amine was used. Sprays were applied to Dakota flax with a medium infestation of Russian thistle, flax in bloom to early boll formation and Russian thistle 6-8 in tall with 10-12 well-formed branches (2,4-D resistant stage). Control ratings for Russian thistle were taken at harvest time, scoring 0-10 (i.e., no effect - complete kill). The table below shows the composition of the spray mixtures (applied at 11.7 gal/A) and control rating for Russian thistle (av. 4 reps.).

Spray Treatment *	Control Rating	Spray Treatment *	Control Rating
Amm. phos. (2N) + 2,4-D	6.0	Na sulph. (2.29 S) + 2,4-D	0.8
" " (8N) "	5.8	" " (9.16 S) "	0.5
Amm. sulph. (2N) "	5.5	K phos. (2.21 P) "	4.0
" " (8N) "	5.2	" " (8.85 P) "	5.0
Amm. nitrate (2N) "	3.2	Amm. K phos.	
" " (8N) "	4.2	(2N + 2.21 P) "	3.0
Urea (2N) "	1.5	Amm. K. phos.	
" (8N) "	2.2	(8N + 8.85 P) "	2.8
Fe nitrate (2N) "	0	Ortho phos. acid	
" " (8N) "	0	(2.21 P) "	4.0
Fe sulph. (2.67 Fe) "	0	Ortho phos. acid	
" " (10.66 Fe)"	0	(8.85 P) "	3.5
Cu nitrate (2N) "	0	2,4-D amine (4 oz acid)	1.0
" " (8N) "	0	2,4-D ester (2 oz acid)	0.5
Cu sulph. (4.54 Cu) "	0	2,4-D ester (4 oz acid)	3.5
" " (18.14 Cu)"	0	Water check	0

* Ounces stated element per acre.

Nitrogen additions were slightly more effective than the phosphorus additions, ammonium nitrogen being better than organic nitrogen (urea). Combined nitrogen, Phosphorus, and potassium was not as good as ammonium nitrogen alone. 2,4-D amine with additions of ammonium nitrogen and phosphorus gave better Russian thistle control than equal rate of 2,4-D ester (no additions). Flax was affected adversely by the additions to 2,4-D amine sprays which caused increased weed control. Degree of damage has not been assessed as yet. (Dominion Experimental Station, Lethbridge, Alberta. Approved for publication by Officer-in Charge.)

Pre-emergence control of certain annual weeds with TCA and CIPC. Warren, G. F. In 2 replicated experiments with vegetable crops on a silt loam soil it was possible to obtain a direct comparison between the effectiveness of TCA, sodium salt, at 4 lb acid equivalent/A and a 4 lb application of CIPC. The treatments were applied in water at 100 gal/A within 3 days after the land was fitted. Treatment dates were June 5 and June 22 and in both cases were followed by heavy rains within a week. In these experiments TCA gave from 91-100% control of foxtail (Setaria lutescens) and crabgrass (Digitaria sanguinalis) but no control of carpetweed (Mollugo verticillata) and velvet leaf (Abutilon theophrasti). CIPC gave from 43 to 75% control of the 2 grasses, 85 to 93% kill of carpetweed and no control of velvet leaf. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana. Approved for publication by the Associate Director of the Agricultural Experiment Station.)

The effectiveness of MCP and 2,4-D are compared in the control of hemp nettle and Tartary buckwheat in cereal crops. W ood, H. E., Craig, H. A., Austman, H. H., Forbes, J. O. At two widely separated points, Teulon and Swan River, heavy infestations of hemp nettle Galeopsis tetrahit in cereal crops were knapsack-sprayed (at Swan River acreages were also machine sprayed) when the nettle was inpre-bud. MCP sodium salt, amine and ester and 2,4-D ester were used at rates of 4, 8, 12 and 16 oz acid equivalent/A in 80 Imperial gal water (machine - 5 oz acid in 5 gal water).

Results: While the nettle was checked slightly at lower dosages, only at the 16 oz rate was it prevented from seeding (Swan River trials did not exceed 12 oz and little or no control was obtained there). It was not possible to differentiate between MCP formulations, however, MCP was rather more effective than 2,4-D, also less damaging to the cereals. At Ethelbert, Tartary buckwheat Fagopyrum tartaricum growing in wheat, and on land being fallowed was knapsack sprayed in the pre-bud stage as above but using only the ester formulation of the two chemicals. Control was nil at 4 oz, slight at 8 oz, but at 16 oz quite promising. At the 16 oz rate results were inconsistent as to formulation for which no explanation can be given, as follows: plots to wheat - MCP 75% buckwheat control; 2,4-D - 60%; in land under fallow MCP 65%, 2,4-D 100%. (Contribution from the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada. Authorized for publication.)

The effectiveness of dalapon on grass-type weeds and the reaction of certain crops to the chemical. Wood, H. E. During the summer, 1953, sq. rod plots were knapsack sprayed with a,a-dichloropropionic acid (dalapon, sodium salt) as follows: June 9 a solid infestation of couch or quack grass, Agropyron repens, at the rates of 10, 20, and 40 lb acid in 160 Imperial gal water/A; June 12, field peas 3-4 in. in height carrying a medium light infestation of wild oats, Avena fatua 4-5 in high with 5 and 10 lb in 80 gal water/A; likewise, June 11, spring- seeded oats very heavily infested with wild oats, both 4-5 in. in height; likewise, June 23, flax-field peas plots (1/2 plot with flax 4-5 in high, 1/2 with peas 6 in high) both heavily infested with green foxtail, Setaria viridis. In addition, a co-operator treated at 10 lb/A both barley and sunflowers infested with wild oats.

Results: Complete eradication of green foxtail was obtained, except on the oat plots, where a light re-growth (whether from seed germinating later or from treated plants was not ascertained) appeared in late July, a large measure of wild oat control was obtained; also with couch grass, excepting that 10 lb may prove to be rather too light an application. All crops were seriously damaged, especially so, with the 10 lb application. It was unfortunate that a lower rate was not used as this chemical may have a place in other than cereals infested with grass-type weeds. (Contribution from the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada. Authority has been granted to publish this abstract.)

CONTROL OF BRUSH ON ROADSIDES, UTILITY LINES AND OTHER RIGHTS OF WAY

Summary

R. H. Beatty

Three abstracts were received for inclusion with this section. They are from the same source and deal with different treatments of the same plant materials.

Buckbrush: Foliage sprays of 2,4-D and/or 2,4,5-T and of ACP 912 killed all stems to the ground, as reported in 1952. MCP did not. In 1953, regrowth was general in all plots, but delayed and mostly abnormal. 2,4,5-T was more effective in preventing regrowth than were the other chemicals. The response to overall dormant sprays followed the same pattern. In these latter treatments, the addition of TCA definitely increased the effectiveness of the other chemicals.

Rose: Response to foliage and dormant over-all treatments was similar to that of buckbrush, but regrowth was more general in all treatments except 2,4,5-T.

Chokecherry: Response to foliage and dormant over-all treatments was similar to that of buckbrush, except that the straight 2,4-D treatments were less effective.

The contributor concludes that with regard to foliage treatments "repeat treatments would be necessary to eradicate any of these three species."

Abstracts

Foliage treatments of buckbrush, rose and chokecherry, 1952 - 1953. Pavlychenko, T. K., Bestrop, A. J. Plots 12x12 ft. of buckbrush (Symphoricarpos occidentalis), rose (Rosa spp.) and chokecherry (Prunus melanocarpa) were treated in full foliage with 10,000 and 20,000 ppm. concentrations of: 2,4-D esters, ethyl (Weedone Concentrate straight and diluted to 9.6 pct.), butoxy ethanol (LV4, straight and LV4 and ACP 129 diluted to 9.6 pct.); esters of 2,4-D and 2,4,5-T (ACP 131, ACP 977, ACP 572, and BK 32 straight, and BK 32 and ACP 977 diluted to 9.6 pct.); esters of 2,4,5-T (Weedone 2,4,5-T straight and diluted to 9.6 pct.); esters of 2,4-D, 2,4,5-T and para (ACP 912); acids of 2,4-D and 2,4,5-T(ACP 926) and amine salt of MCP (Weedar MCP). All treatments were sprayed with 40 gal/A nozzles, ACP 572 being the only chemical sprayed in oil. RESULTS: 1952 results were reported in the 1952 NCWCC Research Report. All chemicals except Weedar MCP killed buckbrush stems to the ground. By the fall of 1953 all plots showed a regrowth that was becoming general. The most effective chemicals, as illustrated by greater delay in regrowth were Weedone 2,4,5-T and its Dilute preparation. On rose, the most effective treatments were Weedone 2,4,5-T and its Dilute preparation. They killed the stems to the ground, but a very delayed and somewhat abnormal regrowth is emerging to the extent of 20 to 35 pct. of the original population. A second group of chemicals (BK 32, BK 32 Dil, ACP 977, ACP 977 Dil., ACP 131, ACP 926 and ACP 572) also killed stems to the ground, but a delayed regrowth up to 65 and 90 pct. was present. The remaining group of chemicals gave incomplete wood kill and regrowth from live portions of stems and roots was general. In chokecherry plots, Weedone 2,4,5-T, 2,4,5-T Dil., BK 32, ACP 912, ACP 926, ACP 572, ACP 977 and ACP 977 Dil. killed all top growth to the ground,

but a delayed regrowth is becoming abundant. The remaining chemicals were less effective. They have incomplete wood kill and general regrowth from both stems and roots. Repeat treatments would be necessary to eradicate any of these three species. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Overall dormant treatments of buckbrush, rose and chokecherry, 1952-1953. Pavlychenko, T. K., Bestrop, A. J. On March 31, 1952, 12x12 ft. plots of buckbrush (Symphoricarpos occidentalis), rose (Rosa spp.) and chokecherry (Prunus melanocarpa) under 4 ft. in height were given overall dormant treatments at concentrations of 25,000 and 50,000 ppm. of esters of 2,4,5-T (Weedone 2,4,5-T) and 2,4-D (Weedone Concentrate), mixture of esters of 2,4-D and 2,4,5-T (Weedone Brush Killer 32) and amine salt of MCP (Weedar MCP). RESULTS: 1952 results were reported in the 1952 NCWCC Research Report. Without further treatments the records were taken in the fall of 1953. All chemicals, except Weedar MCP, killed the buckbrush to the ground. Regrowth from the roots was present in all plots, but delayed and mostly abnormal. 2,4,5-T was more effective in preventing regrowth than the other chemicals: 20 pct. at 50,000 and slightly more at 25,000 ppm. (delayed and abnormal). In Brush Killer 32, at both rates it was more prevelant and still more so in the lower concentration of Weedone Concentrate. Rose reacted somewhat similarily to buckbrush, but regrowth was more general in all treatments except with 2,4,5-T where a small delayed regrowth of 25 and 8 pct. was found in the 25,000 and 50,000 ppm. plots. The chokecherry plots now show quite general but delayed regrowth in all plots, even in the Brush Killer 32 and Weedone 2,4,5-T plots, where the top kill was complete in 1952. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Overall dormant treatments of buckbrush and rose with mixtures of systemic herbicides and TCA, 1952 - 1953. Pavlychenko, T. K., Bestrop, A. J. On April 2, 1952, 12x12 ft. plots of buckbrush (Symphoricarpos occidentalis) and rose (Rosa spp.) were given overall dormant treatments with 25,000 ppm. concentrations of esters of 2,4,5-T (Weedone 2,4,5-T) and 2,4-D (Weedone Concentrate), mixture of esters of 2,4-D and 2,4,5-T (Weedone Brush Killer 32) and amine salt of MCP (Weedar MCP). Another series of plots was treated, using each of the above chemicals mixed with TCA (ACP Grass Killer) at concentrations of 58,000 ppm. in water and applied with 40 gal/A nozzles. RESULTS: Results for 1952 were included in the 1952 NCWCC Research Report. By the fall of 1953 the top growth of buckbrush was killed in all treatments with the systemic herbicides used alone, but numerous delayed shoots were present. The same chemicals, mixed with TCA gave more permanent top kill and suppression of regrowth. 33, 40, 50 and 90 pct. of delayed and much depressed shoots were recorded in the 2,4,5-T, Brush Killer 32, Weedone Concentrate and Weedar MCP plots respectively. Wild rose was killed to the ground with 2,4,5-T and Brush Killer 32 used alone but delayed regrowth of 80 and 75 pct. occurred. Weedone Concentrate and Weedar MCP gave very incomplete top kill and the regrowth was general. The addition of TCA has definitely increased effectiveness of these chemicals. The top kill was complete with all of them and only 10, 20, 22 and 25 pct. of delayed shoots occurred in the 2,4,5-T, Brush Killer 32, Weedone Concentrate and MCP amine plots respectively. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

CONTROL OF BRUSH ON RANGELAND AND PASTURES

Harry M. Elwell

Summary

Abstracts on the Control of Brush for Grassland Improvement were received from cooperators in Texas, Oklahoma, Nebraska, Minnesota, and the Canadian Provinces of Manitoba and Saskatchewan. The woody species studied were white, post, blackjack and dwarf Chinquapin oaks, mesquite, birch, dogwood, hawthorn, silverberry, whitebrush, buckbrush and western snowberry. Most all of these plants were controlled satisfactorily with 2,4,5-T or 2,4-D or combinations of them. Aerial applications of low volatile 2,4,5-T ester were effective on oaks and mesquites. The blackjack was least susceptible to this herbicide. Mesquite was quite satisfactorily controlled with a single application, using 0.66 pound of the acid per acre. Very good defoliation of oak was produced with treatments of 1 pound per acre, and followed a year later by retreatments with the same amount. But further observation will be needed to determine the total kill. Where the chemicals were applied in emulsion of one part diesel oil and 4 parts of water, the results were about as effective as they were from oil alone. Oak sprayed with an airplane in Texas showed marked difference in results due to location, site and vegetation conditions. A higher percentage of mesquite was killed on sandy soils than on heavy, clay sites. Higher kills were also obtained on uplands than on bottomlands. Large yields of native grasses were obtained in one to two years following airplane spraying of dense stands of oaks and mesquites. Whitebrush has generally been most susceptible to the low volatile MCP ester.

Good results on silverberry, hawthorn, birch and dogwood were reported in Canada from foliage treatments with ground sprayers, using several formulations of 2,4-D, 2,4,5-T and MCP in different concentrations and amounts. Comparable rates of 2,4-D in a butyl or Iso Octyl ester were applied on the foliage of western snowberry and no difference could be ascertained between formulations.

Buckbrush was reduced 85 percent in Nebraska by sprayings on May 21 and 28 of 1951 and 1952 with 2,4-D isopropyl ester at the rate of 1 pound per acre. Earlier and later dates of application were less effective. However, poor results were obtained from a 5 year test in Minnesota, made June 13, using 2,4-D and 2,4,5-T esters and combinations of each varying rates up to 5 pounds per acre.

Fall and Spring dormant treatments of silverberry with mixtures of systemic herbicides and TCA were studied in Canada. The treatments in oil gave a complete kill of wood and were superior to those applied in water. The best results of basal treatment on mesquite in Texas was with the ester formulation of 2,4,5-T in diesel oil. CMU produced 80 percent top kill on mesquite trees when applied at the rate of 1 pound per gallon of water.

Abstracts of Results of Cooperators

Aerial spray applications of 2,4,5-T and 2,4-D on post and blackjack oaks, 1952. Darrow, R. A. and McCully, W. G. Aerial applications of 2,4,5-T ester, 2,4,5-T amine and combinations of esters of 2,4,D and 2,4,5-T were made at 7 locations in post and blackjack oak woodland 15 to 35 ft. in height during the period from May 5 to June 16, 1952. Herbicides were applied in oil and 1:3 O/W emulsions at 4 and 8 gals/acre on plots ranging in size from 5 to 40 acres. Amine and low-volatile ester of 2,4,5-T were applied at 1,2 and 3 lbs/acre; combinations of 2,4-D and 2,4,5-T were used at 1½, 2, 3 and 4 lbs/acre. Observations were made in September, 1953, following two growing seasons of less than normal precipitation at most of the plot locations.

Marked differences in results were obtained due to locations, site and vegetation conditions. Under favorable conditions, 60-80% control of post oak and 20-70% control of blackjack oak trees over 6 feet in height were obtained from applications of 3 lbs/acre of 2,4-D and 2,4,5-T esters in 4 gals/acre of emulsion or 2 lbs/acre of 2,4,5-T ester in 4 gals/acre of oil or emulsion. In general, 2,4,5-T ester was superior to 2,4,5-T amine and combinations of 2,4-D and 2,4,5-T esters. 2,4,5-T ester at 1 lb/acre in 4 gals of emulsion gave partial control in open woodland of medium height. A slight advantage was gained by increasing the volume of application from 4 to 8 gals/acre. (Contribution of the Texas Agricultural Experiment Station, College Station, Texas.)

Approved as Technical Article No. 1835 by Director, Texas Agricultural Experiment Station, College Station, Texas.

Control of oak with 2,4,5-T and brushkiller applied by an airplane. Elwell, H. M., Droesson, Jack, Klingman, D. L., and Larson, R. E. Brush, mostly post oak Quercus stellata and blackjack Quercus marilandica, was aerially sprayed at four locations in Oklahoma (Osage, Creek and Grady counties) in June 1952 and June 1953. Plot size for individual treatment was 20 acres. The applications were applied in flight swaths 33 feet wide by a Stearman plane equipped with a five nozzle boom delivering 5 gallons per acre. Below average rainfall has occurred at all locations both years since treatments were begun. Observations were made in September 1953 as to the degree of defoliation as indicated in the following table:

Treatment Pounds Per Acre	Carrier Gals/Acre	% Defoliation Post Oak	Blackjack	% Completely Defoliated Post Oak	Blackjack
2,4,5-T Propylene glycol butyl ether ester					
1	5, emulsion**	58	31	23	2
2	5, emulsion	70	49	27	12
1 / 1*	5, emulsion	83	65	44	15
2 / 1*	5, emulsion	89	70	55	18
2 / 2*	5, emulsion	89	79	61	19
2	10, emulsion***	65	47	29	7
2	5, oil	75	54	32	10
3	5, emulsion	70	60	29	16
Brushkiller (50% 2,4,5-T and 50% 2,4-D, butoxy ethanol ester)					
2	5, emulsion	50	41	16	16
3	5, emulsion	63	48	24	13
1 ½ / 1½*	5, emulsion	85	60	42	12
3 / 1½*	5, emulsion	86	74	50	22
3 / 3*	5, emulsion	92	84	60	30
3	10, emulsion***	58	53	20	20
3	5, oil	71	54	26	17
4½	5, emulsion	61	51	20	11

* 2nd rate applied as a retreatment in June 1953 in same amount of carrier as in 1952.

** Emulsions were 1 gal. chemical and diesel fuel combined in 4 gal. water.

*** Emulsions of 2 gal. chemical and diesel fuel combined in 8 gal. water double flown at 5 gallons per flight.

Brushkiller treatments were all applied at one location in Osage County. Data for 2,4,5-T are averages of treatments in Creek and Grady counties.

Single applications of either 2,4,5-T or Brushkiller in 1952, regardless of rate, were not as effective in defoliating the trees as were applications in 1952 followed by retreatments in 1953. The chemical treatments were more effective on post oak than blackjack oak.

Basal density studies of herbaceous plant vegetation were also made in September 1953. Single applications of both 2,4,5-T and Brushkiller showed basal density of desirable grasses and native legumes increased 60 to 67 percent from light to heavy rates of application. In

the plots retreated with the lighter rates of application, the desirable grasses and native legumes showed a basal density increase of 41 percent over untreated areas. In the plots retreated with the heavier rates of herbicides, desirable grasses and native legumes showed a basal density increase of 82 percent over untreated areas. Retreatments gave excellent control of most broadleaved weeds. (Contribution of the Agronomy Department, Oklahoma Experiment Station, and Bureau of Plant Industry, Soils and Agricultural Engineering, USDA, in cooperation with the PMA, Aerial applicator's Association, and Ranchers.)

Approved for Publication Oct. 29, 1953 by Washington office, USDA.

Basal applications of 2,4-D and 2,4,5-T for control of mesquite. Fisher, C. E., Behrens, Richard and Meadors, Cecil H. Jr. Experimental applications with a wide range of formulations of 2,4-D and 2,4,5-T from 1949 to 1953 indicate that solutions containing 1 percent acid of a low volatile ester of 2,4,5-T in diesel fuel have given the highest percentage root kills of mesquite. Formulations of 2,4-D were less effective than those of 2,4,5-T in nearly all date and rate studies tried during a 5 year period of study. The use of water and oil-water emulsions as diluents decreased the effectiveness of all formulations and chemicals. Thorough wetting of all basal plant parts to the point of runoff was found essential for effective kills of mesquite. The size and growth form of mesquite, whether single, or many-stemmed, and the soil factors of texture and moisture content appeared to influence root kills more than season. The highest percentage root kills were obtained on small plants and single-stemmed trees growing on sandy and porous soils when the moisture content in the surface foot of soil was relatively low. (Contributed by the Texas Agricultural Experiment Station, Spur, Texas and Bureau of Plant Industry, Beltsville, Maryland.

Approved as Technical Article No. 1820 by Director, Texas Agricultural Experiment Station, College Station, Texas.

Effect of soil type and site on control of mesquite when 2,4,5-T was applied to the foliage. Fisher, C. E., Behrens, Richard and Meadors, Cecil H. Jr. Experimental aerial applications from 1949 to 1953 over a wide range of soil types and sites show that root kills of mesquite have been consistently higher, ranging from 30 to 97 percent, on sandy soils than on heavy clay soils, with kills of 0 to 44 percent. Furthermore, higher kills have been consistently obtained on uplands than on bottomlands. Increasing the amount of 2,4,5-T acid from 1/2 to 2 2/3 pounds per acre and varying the volume of diluent from 4 to 12 gallons per acre did not overcome the influence of soil type and site on the root kill obtained. The tendency for the dormant sprout buds and the crown to be buried more deeply on the heavier soils especially

along the bottomlands subject to occasional overflow and soil deposition may account for some of the variation in root kills. (Contribution of the Texas Agricultural Experiment Station, Spur, Texas and the Bureau of Plant Industry, Beltsville, Maryland.)

Approved as Technical Article No. 1825 by Director, Texas Agricultural Experiment Station, College Station, Texas.

Results of five year field trials on buckbrush. Hanson, Henry L. On June 13, 1949, a series of square rod test plots were sprayed to determine the possible effectiveness of different treatments in controlling buckbrush (Symphoricarpos occidentalis, Hook.). All treatments were replicated on from 2 to 4 plots. No grazing was permitted on the plots. In an inspection on July 19, 1949, one treatment (3 lb. 2,4-D ethyl ester per acre) was reported as having "good" results and all others "fair" or "poor". In July, 1950, repeat spraying was conducted on all plots. The types of treatments given in 1949 were as follows: (I) 2,4-D (ethyl ester) at 1 lb. per A.; (II) 2,4-D (ethyl ester) at 3 lb. per A.; (III) 2:1 mixture of 2,4-D and 2,4,5-T (butoxy ethanol esters) at 1 lb. per A.; (IV) 2:1 mixture of 2,4-D and 2,4,5-T (butoxy ethanol esters at 3 lb. per A.; (V) emulsified acid of 2,4-D at 1 lb. per A.; (VI) emulsified acid of 2,4-D at 3 lb. per A. The 1950 treatments were as follows: (A) brushkiller mixture of 2,4-D and 2,4,5-T esters at 2 lb. per A.; (B) 5 lb. per A. brushkiller; (C) 10 lb. per A. brushkiller; (D) 2,4,5-T ester, 2 lb. per A.; (E) 2,4,5-T ester, 5 lb. per A. The resultant combinations of 1949 and 1950 treatments were: IA, II A, III A, IV A, V A, VI A, I B, II B, III B, VI B, V C, VI C, II C, I D, II D, III D, V D, VI D, II E, IV E and VII E.

A final examination of these plots was made on September 23, 1953 after 5 growing seasons. At that time it was evident that none of the treatment combinations had resulted in effective control of the buckbrush. Some size reduction was noted, but the actual brush cover had not been reduced by more than 20 percent on any of the plots. (Contribution of the School of Forestry, University of Minnesota, Agricultural Experiment Station, St. Paul, Minnesota.)

A comparison of mowing and 2,4-D for buckbrush (Symphoricarpos occidentalis) control. McCarty, M.K. Plots 10 x 30 ft. in two replications were established in a pasture seven miles northwest of Lincoln. Sprayings with 2,4-D amine and isopropyl ester were compared on the following five dates, May 14, 21, 28, June 28, and July 16. Mowing was compared with these treatments on the first three of these dates. Treatments were made in 1951 and 1952 with the exception of the 1951

May 14 sprayings which were prevented by weather conditions. The buckbrush was in full leaf with regrowth shoots 4 to 10 inches long by the early treatment date.

Spraying with 2,4-D ester at 1 lb/A for two years gave 85 percent reduction in stand at May 21 and May 28 for the most effective control. Amine at these dates gave from 35 to 50 percent reduction. Two lb of ester on June 28 gave 70 percent reduction in stand while 2 lb. of amine at the same date gave 40 to 50 percent reduction. There was very little regrowth from the old stems in the ester treated plots while the amine showed considerable of the old stems still putting out shoots after two years of treatment. Two years of mowing at the May 14 date gave 30 percent reduction while the two later dates gave 15 to 20 percent reduction. (Contribution of the Division of Weed Investigations, B.P.I.S. & A.E., and the Nebraska Agricultural Experiment Station cooperating.)

Abstract does not require specific approval of the Experiment Station Director.

Plot aerial applications for chemical control of whitebrush. McCully, Wayne G. Low volatile ester formulations of MCP, 2,4,5-T and combinations of 2,4-D and 2,4,5-T applied to whitebrush, Aloysia lycioides, in June, 1952 at 1½ lb/A in 4 and 8 gal/A of 1:3 oil/water emulsion gave 70 to 80 percent kill. General drouth conditions have prevailed since treatment, although plants were in an active stage of growth at the time. The results obtained with 2,4,5-T are difficult to explain on the basis of previous experience. Applications of 8 gals/A were superior to 4 gals/A when a mesquite overstory was present. (Contribution of the Department of Range and Forestry, Texas Agricultural Experiment Station, College Station, Texas.)

Approved as Technical Article No. 1833 by Director, Texas Agricultural Experiment Station.

Absorption and translocation of 2,4-D and 2,4,5-T when applied to the bark of mesquite stems. Meadors, Cecil H. Jr. and Fisher, C. E. Herbicides applied to mesquite stems, were kept in moist contact with the bark at the point of application by means of a gall like wrapping consisting of cotton covered with a water and oil proof tape. Little or no movement took place downward from the point of application. Amine formulations of 2,4-D and 2,4,5-T in oil-water emulsions were absorbed in sufficient amounts to stimulate and affect the growth of foliage above the point of application, however, the stems were seldom killed. Ester formulations of 2,4,5-T gave the highest percentage kill of different sized stems when applied in oil solutions but there was little

or no evidence of movement below the point of application. Increasing the acid content of the ester formulations of 2,4-D and 2,4,5-T above 1 percent in diesel fuel did not appear to influence movement of the chemical. Oil-water emulsions of 2,4-D and 2,4,5-T gave only slightly higher stem kills than the amine formulations when applied to the bark. These results indicate that for effective control of mesquite basal spray applications should be made using an ester formulation of 2,4,5-T in diesel fuel at a concentration of at least 1 percent acid. Furthermore, because of limited downward movement of the chemical in the tissues of mesquite, sufficient amounts of spray solution should be used to reach the sprouting tissues through physical contact. (Contribution of Texas Agricultural Experiment Station, Spur, Texas.)

Approved as Technical Article No. 1823 by Director, Texas Agricultural Experiment Station, College Station, Texas.

Control of mesquite with C.M.U. Meadors, Cecil H. Jr. and Fisher, C.E. Basal applications of C.M.U. in water suspensions at rates of 1/8, 1/4, 1/2 and 1 pound per gallon have given mesquite root kills of 38, 30, 50 and 80 percent respectively. An average of 15 trees were treated with 1 gallon of solution containing the varying amounts of C.M.U. Single stemmed trees less than 3 inches in diameter were more easily killed than large trees with multiple trunks. Suspensions of C.M.U. in diesel fuel appeared to hasten top kills but did not increase root kills. Basal applications of diesel fuel alone at rates of 1 to 2 quarts per tree, depending upon size of plant, gave an average root kill of 80 percent. (Contribution of Texas Agricultural Experiment Station, Spur, Texas.)

Approved as Technical Article No. 1824 by Director, Texas Agricultural Experiment Station, College Station, Texas.

Foliage treatments of birch and dogwood, 1952 - 1953. Pavlychenko, T.K., Bestrop, A. J. Plots of 12x12 ft. of birch (Betula nigra) and dogwood (Cornus spp.) were treated in full foliage with 10,000 and 20,000 ppm. concentrations of: 2,4-D esters, ethyl (Weedone Concentrate straight and diluted to 9.6 pct.), butoxy ethanol (LV4 straight and LV4 and ACP 129 diluted to 9.6 pct.); esters of 2,4-D and 2,4,5-T (ACP 977, ACP 131, ACP 572 and BK 32, straight and BK 32 and ACP 977, diluted to 9.6 pct.); esters of 2,4,5-T (Weedone 2,4,5-T straight and diluted to 9.6 pct.); esters of 2,4,-D, 2,4,5-T and para (ACP 912); acids of 2,4-D and 2,4,5-T (ACP 926) and amine salt

of MCP (Weedar MCP). All treatments were sprayed with 40 gal/A nozzles, ACP 572 being the only chemical sprayed in oil. RESULTS; 1952 records were presented in the 1952 NCWCC Research Report. In August 1953, all treatments were effective. They had killed the stem wood of birch to the ground level with no regrowth. Dogwood reacted in a similar manner. Every chemical and rate killed the stems to the ground, and no regrowth from the roots was observed in this second season after treatment. (Contributed by Agri. Div. American Chemical Paint Company, Saskatoon, Sask.)

Approved for publication by American Chemical Paint Company, Saskatoon, Sask.

Fall and spring dormant treatments of silverberry with mixtures of systemic herbicides and TCA. Pavlychenko, T.K., Bestrop, A. J. On November 12, 1952, 12x12 plots of silverberry (Elaeagnus commutata) were treated at a dormant stage with 1.5 and 3 pct. concentrations of ethyl ester of 2,4-D (Weedone Concentrate), mixture of esters of 2,4-D and 2,4,5-T (BK 64), similar formulation with penta added (ACP 131), ester of 2,4,5-T (Weedone 2,4,5-T) and mixture of acids of 2,4-D and 2,4,5-T (ACP 926), all sprayed in water with 40 gal/A nozzles. Another series of plots was treated, using each of the above chemicals in combination with TCA (ACP Grass Killer) at a concentration of 1.2 pct. (equivalent to approximately 5 lb/A). In addition, both series were repeated with fuel oil as the diluent, also with 40 gal/A nozzle. Each individual treatment was applied, (a) as overall top spray, and (b) as basal spray only. RESULTS: The treatments in oil always gave a complete kill of wood and were superior to those applied in water. Regrowth was about equal with both diluents, ranging from light and delayed with Weedone 2,4,5-T and BK 64 to general and vigorous with Weedone Concentrate. The addition of TCA to the systemic herbicides tended to delay regrowth. In the water treatments, the higher concentrations were more effective in killing tops and reducing regrowth in numbers and vigor than lower concentrations. The basal treatments in water gave much better kill of wood and a higher reduction in regrowth than identical overall applications. A similar set of dormant treatments were given to silverberry on April 27, 1953, to compare them with fall dormant treatments. The main differences noted were: water treatments made in April gave less extensive wood kills than the November treatments; BK 64 and ACP 926 were the more effective chemicals in the water treatments, and gave less regrowth than the others; the addition of TCA in the amounts used did not increase the effectiveness of the systemic chemicals. Basal applications showed no significant superiority to the overall treatments on this species. (Contributed by Agri. Div. American Chemical Paint Company, Saskatoon, Sask.)

Approved for publication by American Chemical Paint Company.

Foliage treatments of silverberry and hawthorn, 1952-1953. Pavlychenko, T.K., Bestrop, A. J. Plots 12x12 ft of silverberry (Elaeagnus commutata) and hawthorn (Crataegus chrysocarpa) were treated in full foliage with 10,000 and 20,000 ppm. concentrations of: 2,4-D esters, ethyl (Weedone Concentrate straight and diluted to 9.6 pct.) and butoxy ethanol (LV4 straight and LV4 and ACP 129 diluted to 9.6 pct.) esters of 2,4-D and 2,4,5-T (ACP 572, BK 32 straight and diluted to 9.6 pct., ACP 977 straight and diluted to 9.6 pct. and ACP 131 straight); esters of 2,4,5-T (Weedone 2,4,5-T straight and diluted to 9.6 pct.; esters of 2,4-D, 2,4,5-T and para (ACP 912; acids 2,4-D and 2,4,5-T (ACP 926) and amine salt of MCP (Weedar MCP). All treatments were sprayed with 40 gal/A nozzles, ACP 572 being the only chemical sprayed in oil. RESULTS: 1952 results were included in the 1952 NCWCC Research Report. In the fall of 1953, the results were highly satisfactory with respect to top kills and regrowth in most treatments. The top growth of silverberry was 100 pct. killed in all plots, only 14 months later, small delayed shoots were observed appearing in 8 of the 32 treatments, mainly in the 2,4-D ester plots. Hawthorn wood was dead to the ground and showed no regrowth with the majority of the treatments. Weedar MCP, LV4, ACP 131 and Weedone 2,4,5-T were the only treatments where occasionally small portions of stems showed some live wood and were producing leaves. (Contributed by Agri. Div. American Chemical Paint Co. Saskatoon, Sask.)

Approved for publication by the American Chemical Paint Company.

A low volatile is compared to a standard 2,4-D ester in treating Western Snowberry. Wood, H. E., Craig, H.A. McKenzie, J. S. and Vodrey, F.C. During 1953 plots of native pasture carrying dense stands of Western snowberry, Symphoricarpos occidentalis were sprayed at the rate of 1½ lbs. acid equivalent per A in which the effectiveness of Iso Octyl was compared to standard esters of 2,4-D. At a location in Winnipeg, sq. rod plots were knapsack sprayed June 3 and July 1, using 160 imperial gallons water per A comparing Butyl with Iso Octyl. Near Winnipeg June 16, 15'x 200' plots, replicated twice, were machine boom sprayed, using 18 gallons water per A when Isopropyl and Iso Octyl were compared. Almost complete top-growth kill of snowberry was obtained on all plots. No difference could be ascertained between formulations. Any apparent advantage would seem to be with early season treatment. Plots sprayed June 3 quickly lost almost all leaves, whereas the July 1 plots carried most of their leaves and only toward the end of the season did the stems become brittle and lifeless. Final appraisal of results must remain until early summer of 1954, as to the amount of re-growth, if any, that may appear. (Contribution from the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada.)

This abstract has been approved for publication.

BRUSH IN FORESTS, TREE PLANTATIONS AND FARM WOODLANDS

H. L. Hansen

Summary

The problems resulting from the presence of undesirable woody plants in forests, tree plantations and farm woodlands are quite different in several respects from the woody weed problems on pastures, roadsides and other areas. Following is a list of the major brush problems:

(1). brush is inimical to the successful natural regeneration of most desirable forest tree species.
(2). preplanting site preparation must be done to control brush preliminary to tree planting on many areas.
(3). successfully established young tree plantations and natural regeneration require continued protection from the competition of brush.
(4). forest stands composed of mixtures of desirable (usually conifers) and undesirable (usually inferior hardwoods) trees should be converted to the most desirable tree species possible.
(5). various species of brush are the alternate hosts for disease or insect organisms. For example, the genus Ribes is the alternate host for the white pine blister rust. The sweetfern (Comptonia) is the alternate host of both a pine rust and an insect (Saratoga spittle bug) damaging jack and red pines.

There are several aspects of these problems resulting from the extensive nature of the forest land-ownership which must be given special attention in developing brush control techniques:

(1). the control must be economic in terms of rather low per acre values involved,
(2). because of the large scale of most forest ownership, a large scale extensive approach to the control of brush is usually indicated.
(3). the areas involved are usually rough, relatively inaccessible and often far from a convenient source of water.

Because of these special problems and limitations, research and investigation in this area has used somewhat different lines of approach from those involved in roadside and pasture brush investigations. Because of cost limitations and because temporary brush control as opposed to eradication is often satisfactory, relatively low concentrations and rates of application have been tried. Aerial applications have been tried with the hope of developing cheap and reasonably effective control methods. Growing season applications have been more popular than dormant season applications because of their lower cost in terms of chemicals. Life history studies of various brush species have been necessary to understand the place played by brush in the long life cycle of the forest crop.

Past and current research has led to the increased acceptance by forest landowners that in at least two forest situations chemical brush control techniques are economic and successful. It is now a common practice where pole sized or larger stands of forest trees contain undesirable species to kill them by several chemical means. Ammonium sulfamate, 2,4-D and 2,4,5-T, as well as sodium arsenite have been most commonly used. In addition, because forest plantations involved considerable cost it is becoming more generally recognized that reasonable expenditures for brush control must be expected if the entire investment in time and planting costs are to be protected. Because of the selectivity of the hormone type herbicides in killing broadleaved brush and doing relatively little damage to conifers, they have been well adapted to this use.

First and second-year responses of scrub oak to CMU. Kuntz, J. E. The effectiveness of several herbicides in eradicating northern pin oak (Quercus ellipsoidalis, 4-6 in dbh) was tested in 1952. Experimental procedures, rates of application, and first-year results have been reported (see Res. Rpt., 9th NCWCC, 1952, pp. 56-57). Limited applications of CMU caused considerable injury to oaks within 25 ft. of the treated area. Injury varied directly with the amount of CMU applied. Many severely injured oaks (foliage completely dead and defoliated) did not refoliate in 1953, but produced large, succulent trunk suckers and weak basal sprouts. Both eventually turned brown and died. Oaks with moderate injury (severe leaf necrosis and partial defoliation) in 1952, often refoliated. However, by midsummer, foliage again turned brown and partially defoliated. Suckers and sprouts often appeared and showed variable necrosis. Oaks with slight injury in 1952, refoliated in 1953, but the leaves eventually showed marginal and interveinal necrosis. Injury to bur oaks was limited to scattered branches. Adjacent large pines often showed severe injury, but small pines escaped. No grass or weeds grew in the sprayed areas. In general responses of oak to other herbicides remained as reported previously.

In 1953, the effectiveness of CMU was tested further as water suspensions, rapidly disintegrating pellets, and slowly disintegrating pellets at 200, 100, 50, and 25 lb./A. Response of oaks to CMU suspensions was comparable to that previously reported. Response to rapidly disintegrating pellets was slower and less severe the first season. By late summer, pellets at 100 and 200 lb./A caused moderate to severe injury on the majority of oaks within 25 feet of the treated areas. At the same rates, slowly disintegrating pellets had killed most grass and weeds, but had injured only slightly the oaks and larger pines. (Contribution of the Wisconsin Agricultural Experiment Station in cooperation with the Wisconsin Conservation Department and the Nekoosa-Edwards Paper Company.)

Chemical control of sweetfern. Kuntz, J. E. and A. J. Riker. Burn blight, a sporadic though destructive disease of young jack pine and red pine on sandy sites in the Lake States, is spread by the Saratoga spittle insect (Aphrophora saratogensis). At present the disease is reduced by repeated aerial applications of DDT against the spittle insect. Sweetfern (Comptonia peregrina) serves as the main alternate host for the insect (nymphal stage). Eradication of this host plant, as happens naturally when the crown canopy closes, might practically eliminate the insect and thus control the disease. CMU as water suspensions at 3, 6, 12, 25, and 50 lb./A and 2,4-D + 2,4,5-T, 5% in fuel oil (propylene glycol butyl ether esters) were tested. Dormant, bud-break, and full-leaf applications were made to replicated 1/150 A plots. Response to CMU was slow, regardless of the date of application. By midsummer, 12 to 50 lb./A killed above ground parts of grasses, weeds, sweetfern, and blackberries with no resprouting. Jack and red pines also showed severe injury. Lower rates caused variable injury but allowed resprouting. The response of sweetfern to 2,4-D + 2,4,5-T in oil varied with the date of application. Dormant treatments gave poor top kill and allowed considerable recovery and resprouting. Treatments at bud-break and full leaf, however, gave complete top kill of sweetfern and no resprouting the first season. Blackberries showed less injury and some resprouting by fall. Pine trees showed injury only on sprayed lower branches. (Contribution of the Wisconsin Agricultural Experiment Station in cooperation with the Wisconsin Conservation Department and the Nekoosa-Edwards Paper Company.)

Dormant basal treatments of large poplars and birch. Pavlychenko, T. K., Bestrop, A. J. On November 15, 1952, plots of poplar (Populus tremuloides) and paper birch (Betula papyrifera), each consisting of several large trees (D.B.H. 6 to 8 in.) were sprayed wet up to 3 ft. above the ground with 1.5 and 3 pct. concentrations of ethyl ester of 2,4-D (Weedone Concentrate), mixture of esters of 2,4-D and 2,4,5-T (BK 64), similar formulation with penta added (ACP 131), ester of 2,4,5-T (Weedone 2,4,5-T) and mixture of acids of 2,4-D and 2,4,5-T (ACP 926) in water. Another series was similarly treated with fuel oil as the diluent.

Results: Poplar was effectively controlled by all the chemicals and rates used in oil. Leaves had all died in the early stages of development. Bark was badly discolored or dying far up above the treated zones and cambium was killed especially with 2,4,5-T. In the water sprayed series the leaves were still present in August in every treatment and only the sprayed areas of wood were affected as indicated by dry discolored bark. Paper birch was more resistant to all chemicals. In oil, the most effective chemicals (both concentrations of BK 64 and Weedone Concentrate) killed the foliage in the early stage of development, but the effect on wood was negligible. The remaining chemicals were also ineffective on trunks and only partially destroyed the foliage. All water treatments had no visible effect either on wood or foliage. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Dormant treatments of small poplars with mixtures of systemic herbicides and TCA, 1952. Pavlychenko, T. K., Bestrop, A. J. On November 1, 1952, 12 x 12 ft. plots of small, second growth poplar (Populus tremuloides) in a burned over area were treated at a dormant stage with 1.5 and 3 pct. concentrations of ethyl ester of 2,4-D (Weedone Concentrate), mixture of esters of 2,4-D and 2,4,5-T (BK 64), a similar formulation with penta added (ACP 131), ester of 2,4,5-T (Weedone 2,4,5-T) and mixture of acids of 2,4-D and 2,4,5-T (ACP 926), all sprayed in water with 40 gal./A nozzles. Another series of plots was treated, using each of the above chemicals in combination with TCA (ACP Grass Killer) at a concentration of 1.2 pct. (equivalent to approximately 5 lb./A). In addition, both series were repeated with the same volume of fuel oil as the diluent. Each individual treatment was applied, (a) as overall top spray, and (b) as basal spray only.

Results: In 1953, none of the treated plots had foliage. Where systemic chemicals alone were sprayed in water, Weedone 2,4,5-T and BK 64 were the most effective chemicals. They killed the wood to the ground, with no regrowht. The remaining chemicals in this series, Weedone Concentrate in particular, gave incomplete wood kills with some delayed regrowth present, mostly with the 1.5 pct. concentrations. When the above chemicals were applied alone in oil, effectiveness was increased appreciably. With 2,4,5-T leading, even the less effective chemicals gave complete wood kill with no regrowth. The basal treatments in this test showed no readily observable differences in effectiveness, as compared with the overall applications through the whole set of treatments. The advantages of adding TCA in the amounts used also could not be clearly traced. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Resprouting of mountain maple after basal spraying with 2,4,5-T. Roe, Eugene I. Clumps of mountain maple (Acer spicatum), growing under an aspen-hardwood stand in northern Minnesota, with stems ranging up to two in. in diam. and 15 ft. in height were basal sprayed with 0, 1, 2, 4, and 8 percent solutions by volume of polypropylene glycol butyl ether esters of 2,5,5-T (Esteron 245) in mid-November, 1950. Similar clumps of this shrub were sprayed with the same concentrations of this herbicide (0, 5900, 11,800, 23,400, and 46,100 ppm) in early May, 1951, when the

buds were beginning to open and a third series in mid-November, 1951. In all cases, No. 1 fuel oil was used as the diluent. Examination in the summer of 1953 showed that while top kill had been practically complete on all treatments save the 0 and 1 percent solutions applied in May 1951, there has been an appreciable amount of resprouting. However, the ratio of new sprouts to stems before spraying and also sprout vigor show a general decline with increase in concentration of 2,4,5-T. Of the three spraying dates, May-sprayed clumps showed the greatest ability to sprout and also the most vigorous sprouts. On the basis of these small-scale tests, mountain maple clumps can be killed and resprouting kept at a minor level by basal spraying in late fall with a 2 to 4 percent solution of 2,4,5-T in No. fuel oil. Fuel oil alone or a 1 percent solution of the herbicide applied at this time will also give good top kill but will be followed by an abundance of vigorous sprouts. (Lake States Forest Experiment Station, Grand Rapids, Minnesota.)

CONTROL OF WOODY PLANTS IN OTHER PROBLEM AREAS INCLUDING ALTERNATE HOSTS AND POISONOUS PLANTS

Summary — L. W. Melander

Since this summary covers a comparatively new and rather specialized section of woody plant research, very little data has been made available to summarize.

Barberry - alternate host of stem rust of wheat, oats, barley and rye. European barberry (Berberis vulgaris) is readily killed with MCP ester in oil solution (10.5 to 14 pounds ahg) applied as a basal spray with special emphasis on the ground line. The abstract following this summary adds chloro IPC to the list of herbicides that will kill European barberry. This abstract also establishes the fact that this herbicide may be of use in killing other types of woody plants, especially in the dormant stage. There is also indication that some formulations of 2,4,5-T ester also will kill this shrub as well as a combination of 2,4-D and 2,4,5-T esters plus a penetrant. The barberry eradication project is continuing to use the hormone-type herbicides on a year around operation basis. Colorado barberry (B. fendleri) is being eradicated in both the foliage and dormant stages with 2,4-D esters in water emulsions (1.6 pounds ahg) and oil solutions (14 pounds ahg) respectively. In the Virginias, the Allegheny barberry (B. canadensis) is being killed with a combination of 2 parts 2,4-D to 1 part 2,4,5-T plus pentachlorophenol in an oil solution (14 pounds ahg) applied to both the foliage and dormant stages. Since native barberries produce rhizomes and grow in patches, the bushes are sprayed thoroughly with special emphasis on the ground line. The surrounding soil also is sprayed to 4 feet beyond the last "shoot." Three years after initial treatment the regrowth appears to be less than 5 percent.

The decision as to what type of herbicidal treatment (foliage or dormant) to use on native barberry raises the question as to when actively growing or foliage stage ends and when dormancy starts, and conversely when dormancy ends and foliage stage starts. When different concentrations are used for each stage, the determination of the duration of these two stages is essential. When to discontinue foliage spraying and to start dormant spraying is difficult to determine. Under actual field conditions the dormant spray is used when there is evidence that the plants have ceased growth and the leaves and stems have hardened off. Since the time of this change varies, there is a danger that spraying crews will in some years use the foliage sprays too late in the season. It is important that the dormant-stage spray be started early enough to allow a sufficient margin of safety. When to discontinue dormant spraying and start foliage spraying is more clear-cut. This time seems to be when the leaves are fully developed and there is evidence of new shoots.

Ribes spp. - gooseberries and currants - alternate hosts of white pine blister rust. The blister rust control project in the Lake States continued to have good success in killing upland species of gooseberries and currants (Ribes cynosbati, R. missouriense, and R. americanum) with esters of 2,4,5-T applied as a basal spray. In addition, the latter species is very sensitive to 2,4-D esters. During the past year, this summarizer has supervised some additional herbicidal tests on various species of gooseberries and currants: Ribes cynosbati, R. oxyacanthoides, R. hirtellum,

R. triste, and R. glandulosum. The latter three species are swamp inhabiting species and constitute a difficult manual eradication problem. However, it appears that some of the hormone-type of chemicals as well as chloro IPC may help to reduce costs of eradicating these swamp species of ribes. R. oxyacanthoides is a rock inhabiting species that appears sensitive to esters of 2,4-D, 2,4,5-T and MCP. Final data on results will not be available until 1954.

Buckthorn - alternate host of crown rust of oats. No reports of research on herbicides for killing buckthorn have been submitted. Since information on this subject is needed, it is hoped that there will be significant data submitted for the 1954 report.

Juniperous spp. - alternate hosts of apple and pear rust. No abstract or data were submitted. Definite, accurate information is needed.

Poisonous woody plants. There were no abstracts nor data submitted that could be used in this summary. It is recommended that more experimentation on killing poisonous woody plants with herbicides be expedited.

Abstract

Effect of chloroisopropyl carbamate (chloro IPC) on European barberry (Berberis vulgaris) in Pennsylvania. Melander, L. W., and Campbell, Mac A. On September 29, 1951, three European barberry bushes were treated with a 14-pound ahg oil solution (pounds of acid equivalent in 100 gallons) of chloro IPC. The treatment consisted of thoroughly spraying the ground line and crown of the bushes. On June 6, 1952, all three of the treated bushes appeared to be dead. On August 14, 1952, 22 additional barberry bushes were treated in like manner with concentrations of 3.75, 7.50, 11.25, 15.0, and 22.5 pounds ahg in oil. On June 18, 1953, when observations were made, all bushes were dead or showed definite symptoms that they would soon die. No sprouting was apparent at the time the observations were made.

These results indicate that chloro IPC in the concentrations used has sufficient herbicidal properties to kill European barberry, a woody plant.

CONTROL OF HERBACEOUS WEEDS IN TREE PLANTINGS

James E. Kuntz

Summary

The survival and growth of young fruit and forest plantations, particularly of broadleaves, are adversely affected by weed competition during the first few years. Grass is especially detrimental. Weed control by mechanical cultivation often has various limitations. Recent investigations have indicated considerable promise with chemical herbicides. Maximum response has occurred with fast-growing species like hybrid poplars. Tree species and age, soil type, moisture relations, weed species and age, season of application—all have influenced results and need clarification. Even weed control in forest nurseries, though well established in principle, merits continued study as to improved materials and methods.

Abstracts

The reaction of certain fruit crops to Dalapon when applied in close proximity thereto for grass control. Davidson, J. H. Applications of Dalapon at 3, 5, 10, 20, and 40 pounds technical acid equivalent per acre were applied for the control of quack grass (Agropyron repens) in close proximity to certain deciduous fruit crops. Applications were made with a Knapsack sprayer at the rate of 40 gallons per acre. An attempt was made to wet the grass foliage without runoff on the soil. Dalapon was applied as the sodium salt with wetting agent. Apples (Jonathan) and Pears (Bartlett) tolerated the 40 pound rate with only a trace of foliage necrosis and chlorosis. Cherry (Montmorency), Plum (Monarch) and Peach (Elberta) showed foliage necrosis and chlorosis at 3 pounds per acre with serious injury at 20 pounds. Grape (Concord) tolerated the 10 pound rate safely. Higher rates caused foliage necrosis. The above applications were made May 19. Rainfall during the following ten days consisted of 0.5 inch May 22 and 0.4 inch May 26. No regrowth of quack grass was evident on the 20 and 40 pound rate treatments October 6. At the lower rates, regrowth was less where the treated areas were shaded. Observations on the degree of injury in 1954 from these treatments will be made. (Contribution of The Dow Chemical Co., South Haven, Mich.)

A weed control program for a conifer nursery. Day, Maurice W. During the past few years the following weed control program has been developed at the Dunbar Forest Nursery, which is exclusively devoted to the production of conifers. Spraying with mineral spirits is the principal means of control with a limited amount of hand weeding. Both fall and spring sown seed beds are also treated with a 2% sulphuric acid solution at time of sowing. At the first sign of weeds in the spring and usually before the conifers have emerged, these beds are sprayed (Standard Weed Killer used in 1953) using a tractor boom sprayer, tractor speed 4 mph, pressure 20 psi with a Teejet 8003 nozzle. Spraying is continued at approximately 1 week intervals throughout the summer. Spraying is not, however, done on cloudy or rainy days. After the first 6 weeks the pressure is increased to 25 psi. This results in the application of about 18 gal./A. On the transplant beds the same spray procedure is used except that the pressure used early in the season is 60 psi and is later stepped up to 70 psi, this later pressure results in an application of about 29 gal./A. Spraying is most effective when the weeds are very small and must not be delayed until the weeds are plainly evident. Once or twice during the summer a cleanup of the beds by hand weeding is necessary to remove weeds that have become too large to be killed by the spray. Spraying is not very effective after the first of September and hand weeding is used for the fall cleanup of the beds that will be held over another

year. Especially care should be taken at this time to remove the grasses which grow late in the fall and are difficult to remove if left until spring. This weed control program has resulted in great savings in labor and at the same time has given better weed control. (Contribution from Michigan Agricultural Experiment Station, Dunbar Forest Experiment Station.)

Chemical weed control in 2-year-old poplar plantations. Kuntz, J. E. To test the effects of several commonly-used herbicides on older trees, sprays were applied in the spring to 3-ft wide strips along rows of 2-year old poplars and 6-year old pine. On muck, 2,4-D at 4 lb/A (propylene glycol butyl ether ester); and mixtures of 2,4-D at 4 lb/A plus CIPC at 20 lb/A; plus TCA at 10 lb/A; and plus endothal at 20 lb/A all gave good initial control of annual weeds without injury to trees. By midsummer, however, regrowth was abundant. CMU at 5 and 10 lb/A and a mixture of CMU at 2.5 lb/A and 2,4-D at 4 lb/A gave excellent and sustained weed control with little or no injury to poplars. Similar results were obtained on a heavy silt-loam site. On coarse gravel, results were similar except that CMU at 10 lb/A severely injured both poplar and pine, as did CMU at 5 lb/A on sand. In many situations, combinations of CMU at 2.5 lb/A with CIPC or endothal at 20 lb/A or with TCA at 10 lb/A have given good weed control with negligible injury to trees. (Contribution of the Wisconsin Agricultural Experiment Station in cooperation with the Wisconsin Conservation Department and the Nekoosa Edwards Paper Co.)

Prolonged effects of CMU on weeds and trees in forest plantations. Kuntz, J. E. The effects of CMU as well as other herbicides on weeds and trees two and three years following application were studied. Both dormant cottonwood cuttings and jack and red pine transplants were replanted in treated plots. On sand, after 3 years, CMU at 20 and 40 lb/A permitted no regrowth (area bare) and caused variable injury to trees. After two years, CMU at 5 and 10 lb/A permitted only sparse regrowth with no injury to trees. CMU at 20 lb/A, however, severely injured or killed all replanted trees. On a heavy loam site, after two years, CMU at 5 lb/A permitted moderate regrowth of weeds, but no injury to trees. CMU at 10 and 20 lb/A gave continued excellent weed control (area bare), but caused severe injury to both pine and poplar. On muck, after two years, CMU at 5 and 10 lb/A caused little injury to either weeds or trees. CMU at 20 lb/A permitted no regrowth, but caused considerable injury to trees. First-year results with CMU applied to an alluvial sand high in accumulated organic matter were similar to those previously reported on muck (see 9th Ann. Res. Rpt. NCWCC, pp 58-59). (Contributions of the Wisconsin Agricultural Experiment Station in cooperation with the Wisconsin Conservation Department and the Nekoosa Edwards Paper Company.)

SPRING SOWN GRAIN

Summary

Neal E. Shafer

Wheat Seven abstracts dealing with the use of herbicides in wheat were received. Three of these were results of investigations carried out on the difficult problem of controlling grass weeds selectively in growing wheat. IPC, CIPC, MH, TCA, CMU, Endothal, and Dalapon were used when wheat was in the 5 to 6 leaf stage. IPC and CIPC had no effect on the wheat or weeds. Endothal did not affect wheat yields or wild oats growth but eliminated green foxtail. All other chemicals injured weeds and wheat approximately the same. Four abstracts reported results obtained from the use of low volatile esters, high volatile esters, amines, and MCP at various rates and at several stages of growth. Wheat exhibits decreasing tolerance to herbicides in the order given; MCP amine, MCP low volatile, 2,4-D amine, 2,4-D low volatile ester and 2,4-D high volatile ester. One investigator found no difference between several low volatile esters and an alkyl ester. Another found significant yield reductions from ester applications as low as 1/4 pound made when the crop had only 2 leaves, and from 1/2 pound applications through the period 36 to 60 days after emergence.

Oats Of the six abstracts submitted on oats five reported results comparing 2,4-D and MCP. Oats appear to be more tolerant of MCP than of 2,4-D. The period of high meristematic activity at the time of node formation appears to be the most sensitive to 2,4-D or MCP herbicides. The plant generally has 5 leaves at this stage of development. A second sensitive period but to a lesser degree occurs at the early boot or early shot blade stage. Use of amine 2,4-D at 1/8 to 1/2 pound and amine MCP at 1/8 to 1 pound on oats undersown with legumes resulted in better legume stands and eliminated 80 to 100 per cent of turnips sown as broad leaved weeds. A low volatile ester used at 1/8 and 1/2 pound was safe only at the 1/8 lb. rate. Chloro-IPC applied three days after seeding controlled the turnips without injuring oats or legumes. Amine DNBP applied when oats had 3 leaves controlled turnips without injury to oats or legumes. TCA applied just after seeding eliminated oats and legumes with no damage to turnips.

Barley See abstracts by Pavlychenko et al and abstract by Friesen included under wheat but also reporting on barley.

Abstracts of contributors

Wheat

Effectiveness of Dalapon on green foxtail (Setaria viridis) and wild oats (Avena fatua) and the reaction of the wheat to the chemical. Breakey, W. J. On June 16, 1953, plots of wheat heavily infested with wild oats and green foxtail were sprayed with a, a-dichloropropionic acid (Dalapon Sodium Salt) at rates of 5 and 10 pounds acid in 11 Imperial gallons of water per acre. The weather at time of spraying was warm (78°); during the night after spraying .62 inches of rain fell. The green foxtail was 1 to 2 1/4 inches tall, the wild oats 3 to 4 inches, and the wheat 4 to 5 inches tall. Complete eradication of the green foxtail was obtained at an early date while at the same time it was apparent that the wheat and wild oats were being damaged. By late July the wheat and the wild oats were severely damaged and 6 to 8 inches shorter than the check. The 5 pound rate treatment was less severe than the 10 pounds, although both treatments severely

damaged the wheat and the wild oats. (Contribution from the Dominion Experimental Station, Morden, Manitoba.)

The effect of Endothal 3003 on green foxtail (Setaria viridis) and wild oats (Avena fatua). Breakey, W. J. On June 11, 1953, plots of wheat severely infested with green foxtail and less heavily infested with wild oats were sprayed with 1, 2, and 3 U. S. gallons of Endothal 3003 in 11 Imperial gallons of water. Temperature on day of spraying was 79° F. and the day following 82° F. The atmosphere was dry, with no rain falling 4 days previously and for 4 days after spraying. The green foxtail was from 1 to 2 1/4 inches tall and the wheat 4 to 5 inches high. The Endothal delayed maturity from one to three days. The treated plots were 1 1/2 in. shorter than the checks. The green foxtail was completely eradicated, while there was no apparent damage to the wild oats. There was no significant difference in the yield of the treated and untreated plots. Samples of treated and untreated wheat have been set forward for analyses. Seed is being kept to test for any sterility. (Contribution by the Dominion Experimental Station, Morden, Manitoba.)

Effects of several rates of three low volatile esters and one alkyl ester of 2,4-D on spring wheat and annual weeds. Dersheid, Lyle A. and Wallace, Keith E. Quadruplicate 1-rod x 5-rod plots of wheat were treated with a butoxy ethanol ester, a propylene glycol butyl ether ester, an iso-octyl ester or a 4-lb. mixture containing isopropyl and butyl esters. Rates of 1/8, 1/4, 1/3, or 1/2 lb/A were applied to Mida wheat in western South Dakota near Strool on June 10, 1953, when wheat was in 5- to 6-leaf stage and in central South Dakota near Yale on June 17, 1953, when wheat was in 7-leaf stage. Treatments were applied in water at the volume of 10 gal/A. Yield data were obtained on 5 sq. yds. of each plot and analyzed statistically. It was not established that any treatment caused the yield to be different from that of the untreated weedy check. Sunflowers were present on all plots and field bindweed and milkweed were present on some at Yale, while wild buckwheat was present at Strool. None of the treatments had any effect on milkweed and none of the treatments appeared to completely kill the other weeds. All treatments stunted the growth of all weeds so that harvesting could be accomplished; whereas, sunflowers on untreated areas hampered harvesting operations. All treatments allowed regrowth of sunflowers and wild buckwheat at Strool, but 1/3 lb/A of the iso-octyl ester and 1/2 lb/A of all prevented regrowth of sunflowers at Yale. These data indicate that at least 1/3 lb/A and probably more 2,4-D is needed to prevent regrowth of sunflowers, that these 3 low volatile esters are not more injurious to crops than this alkyl ester, and that spraying in a year when there is ample soil moisture does not increase yields but does facilitate harvesting. (Contributed by the Agronomy Department, South Dakota Agricultural Experiment Station, College Station, South Dakota.)

The effect of 2,4-D and MCP sprayed on wheat at twelve different stages of growth. Friesen, H. A. In 1952, 2,4-D butyl ester at dosages of 1/8, 1/4, and 1/2 lb/A, 2,4-D mixed amines and MCP amine each at 1/2 lb/A were sprayed on wheat at 12, 6 day intervals beginning at emergence. The weed infestation was not heavy, averaging 122 plants per square yard. Ninty-three per cent of the weed population was composed of (Thlaspi arvense), the remainder were (Salsola pestifer)and (Polygonum convolvulus). Each of the treatments, with the exception of the 2,4-D ester at 1/8 lb/A resulted in highly satisfactory kills of Thlaspi, over 80 per cent, at all stages of growth prior to the late flowering stage. Similar kills were

obtained with 2,4-D ester at 1/8 lb/A in only the very early seedling stages of growth. Due to the very light and spotty infestation of Salsola and Polygonum the effect of the herbicides on these weeds could not be accurately assessed. The excellent kills of Thlaspi resulted in significant yield increases during treatment dates 4 and 5, i.e. the 4 to 6 leaf stage of growth. At date 3, 18 days after emergence, when the crop was in the 2 leaf stage the yield was depressed by the 2,4-D ester at dosages of 1/4 and 1/2 lb/A. The 2,4-D ester at 1/2 lb/A also significantly depressed the yield at dates 6, 7, and 8. At dates 9 and 10, the period just prior to heading, each treatment significantly depressed the yield. Sprayer damage resulted in some yield reductions at dates 11 and 12.

This test has been conducted as a two year rotation on the same plots for the past 3 years. The grain was sown on well prepared summerfallow each year and weed seeds were not planted on these plots. The three year's results have emphasized the need for early treating but not before the wheat plants had advanced to the 4 leaf stage of growth. The crop showed a somewhat greater tolerance to the MCP amine and 2,4-D amine than to the 2,4-D ester.

In a similar test, in which the 2,4-D ester at 1/4 lb/A was sprayed on wheat in the 4 to 5 leaf stage of growth on summerfallow, the average yield increase over the past 7 years has been 5.7 bushels per acre. A further observation has been that on these plots the population of annual weeds such as Thlaspi and Salsola prior to spraying has become markedly reduced. This would indicate that spraying the growing crop over a period of years has been effective in decreasing the numbers of weed seeds produced and has thereby reduced the severity of the infestation. (Contributed by the Dominion Experimental Station, Scott, Saskatchewan.) 1953.

A comparison of the effect of 2,4-D versus MCP on cereals and flax. Friesen, H. A. An MCP ester and amine and a 2,4-D ester and amine were each sprayed at 1/4 and 1/2 lb/A on replicated plots of wheat, barley, oats, and flax. The cereal grains were in the 4 to 5 leaf stage of growth and the flax had 3 to 4 true leaves at the time of spraying. The weed infestation was too light to permit assessing the merits of the various treatments as weed killers. Wheat and barley appeared to be unaffected by either the MCP or the 2,4-D treatments. Deformed plants or reduced yields did not result from any one of the treatments. The yield of oats was significantly reduced by applications of the 2,4-D ester and amine at 1/2 lb/A. Furthermore, the oats were stunted, the stems were brittle and there were many sterile florets. The other 2,4-D ester and amine and to a lesser degree the MCP treatments caused some stunting and floret sterility but the damage was not sufficiently severe to cause any significant yield reductions. The effects of the 2,4-D ester at the 1/4 and 1/2 lb/A rates and the 2,4-D amine at 1/2 lb/A on flax were most interesting in that the treated plants were all greatly deformed (fused leaves, multiple branches and heavy lesions on the roots) and the date of maturity was delayed by 2 to 3 weeks. However, neither the 2,4-D ester nor the 2,4-D amine treatments significantly depressed the yield. The 2,4-D amine at 1/4 lb/A and the MCP treatments resulted in very few deformed plants, little or no delay in maturity, and no reduction in the yield of the flax. (Contributed by the Dominion Experimental Station, Scott, Saskatchewan.) 1953.

The effect of various chemicals on wild oats in wheat. Friesen, H. A. IPC, CIPC, MH, TCA, CMU, and Dalapon were each sprayed at the rate

of four pounds of active ingredient per acre on wild oats growing in Rescue wheat. Both the wild oats and the wheat were in the 5 to 6 leaf stage of growth when sprayed. Water was used as a carrier for spraying each of the herbicides. Growing conditions after spraying were abnormally dry and warm. Results: IPC and CIPC had no measurable effect on either the wild oats or the wheat. MH very severely stunted the growth and delayed the maturity of the wild oats. Twenty per cent of the wild oats failed to head at all. The treated wild oats were some six inches shorter and matured 40 per cent less seed than the untreated plants. The wheat was affected in the same way except that the number of seeds matured on the treated plants was some 60 per cent less than on the untreated. TCA severely stunted the wild oats, especially the late tillers. However, nearly all tillers matured seed. CMU resulted in a 30 per cent reduction in the stand of both the wheat and wild oats. The surviving plants, however, appeared to be normal. Dalapon resulted in extreme malformation of the wheat. The plants only reached a height of 6 inches while the untreated plants grew 30 inches tall. Only some 50 per cent of the plants produced heads and these were club-like and sterile. The wild oats obtained a height of some 14 inches but only a few plants headed out and produced seeds. (Contributed by the Dominion Experimental Station, Scott, Saskatchewan.) 1953.

A comparative test of effectiveness of low volatile esters and MCP salts against common 2,4-D formulations on wheat. Pavlychenko, T. K., Bestrop, A. J. A large scale field test was conducted in 1953 on clay loam soils at Hanley, Young, and Rosthern, Saskatchewan to compare the action on wheat (Triticum vulgare) and weeds of the low volatile esters, butoxy ethanol ester of 2,4-D (Weedone LV4, 3, 5, and 10 oz/A) and of MCP (ACP 904, 3, 6, and 8 oz/A), and amine salt of MCP (Weedar MCP, 4, 8, and 12 oz/A) against the volatile ethyl ester of 2,4-D (Weedone Concentrate, 3, 5, and 8 oz/A) and the amine salt of 2,4-D (Weedar 80, 4, 8, and 12 oz/A), when wheat was 5 - 6 inches tall. The weed infestation was light and very uneven consisting of wild mustard (Sinapis arvensis), stinkweed (Thlaspi arvense), redroot pigweed (Amaranthus retroflexus) and wild buckwheat (Polygonum convolvulus). Results: The low volatile LV4 was equally effective on weeds but more tolerant to wheat than the volatile ethyl ester. The low volatile esters of MCP, ACP 904, caused a severe stunting to older weeds, killed some young weed seedlings and was much more tolerant to wheat than LV4, and particularly the ethyl ester of 2,4-D (Weedone Concentrate). The same was true, but to a greater degree, of MCP amine. Due to light weed infestation, yields in check plots were quite high. Yet the yields in treated plots were higher in every case, particularly with MCP treatments. This seems to suggest that agriculturally desirable chemicals are those which control the weeds even without killing them outright, and are sufficiently tolerant to the treated crop. The two low volatile esters and the MCP amines have definitely showed tolerance to wheat in this test. For best results early treatments are essential with all milder chemicals. (Contributed by Agricultural Division, American Chemical Paint Company, Saskatoon, Saskatchewan.)

Oats

Effect of 2,4-D and MCP on Exeter Oats, 1953. Brown, D. A. Ester and amine formulations of these two compounds were used at acid equivalent rates of 4 and 8 oz/A respectively. Applications were made with a boom type plot sprayer delivering 12 gal. water per acre. Crop was treated at 20 stages of growth between emergence of plants and complete

heading. In contrast to results during the previous four years the oats crop showed very little toxicity to any of the treatments at any stage of growth. This may have been due to weather conditions. Sixteen of the twenty treatments were applied in dull, cool, moist weather. Heavy rains were general throughout the spraying period June 17 to July 13. Yields significantly lower than the check were obtained only from plots treated with 2,4-D butyl ester 4 oz/A between the 5 and 12 dates of application when plants were from 4 to 9 in. high. Weakened straw was the only manifestation of injury on these plots and these were the only plots in the entire test exhibiting a degree of injury that could be attributed to the herbicide. While no striking results were obtained in 1953, the findings of previous years were substantiated i.e., that the oat plant is sensitive to 2,4-D ester in dosages as low as 3 oz/A acid equivalent at stages of growth from approximately 5 to 10 inches. Amine at 6 to 8 oz/A acid equivalent is to be preferred to the ester. MCP formulations would appear to be less harsh on oats but proof of this will depend on the results of further tests. (Contribution by Experimental Farm, Brandon, Manitoba.)

Reaction of oats to 2,4-D amine and MCP butyl ester when applied at 10 different stages of growth. 1953. Burrows, V. D. and Olson, P. J. Exeter oats were sprayed with 10 oz. acid equivalent per acre of both 2,4-D amine and MCP butyl ester. Treatments were started 12 days after emergence and continued at 3 day intervals until 10 applications were made. The only significant yield reductions were caused by 2,4-D amine when applied at the early 4 and 5 leaf stages of growth (7 - 10 in. stretched height). This damage was visible in the field. The plants possessed erect culms, narrow dark green leaves and panicles with a high degree of sterility. Corresponding plots treated with MCP did not exhibit these symptoms. MCP appears to be the safer herbicide to use for controlling susceptible weeds in oats. (Contribution from the Division of Plant Science, the University of Manitoba.)

The reaction of oats to 2,4-D and MCP applied at 20 stages of growth. Friesen, H. A. 2,4-D butyl ester at 1/4 lb/A, 2,4-D alkanolamine at 1/2 lb/A, MCP butyl ester at 1/4 lb/A and MCP triethanolamine at 1/2 lb/A were sprayed at 3 day intervals on plots of Exeter oats. The first treatment was made at full emergence and the last after the kernels had begun to fill. Results: None of the treatments resulted in severe malformation of the leaves and stems, this may be largely due to the extreme drought during the growing period from the 2 leaf stage until the late boot stage. Suppression of growth vigor and floret sterility was sufficiently severe where the 2,4-D amine was applied at 1/2 lb/A, to cause significant yield reductions during the period at and just prior to node formation; dates 5, 7, and 8 and again during the early shot blade stage, dates 13 and 14. Yield reductions were not generally as severe where the 2,4-D ester was applied at 1/4 lb/A. However, the yield was significantly lowered by this treatment during the 4 and 6 leaf stages of growth; dates 3 and 6, respectively, and during the shot blade stage dates 13 and 16. The oats were decidely more tolerant to the MCP treatments than to the 2,4-D treatments. MCP amine at 1/2 lb/A significantly depressed the yield only during node formation dates 8 and 9 and during the preheading stage, date 17. The MCP ester at 1/4 lb/A caused a significant reduction in the yield of oats at date 11, just after node formation had taken place and stems were beginning to elongate. (Contributed by the Dominion Experimental Station, Scott, Saskatchewan.) 1953.

Effect of four low volatile esters of 2,4-D and isopropyl ester of 2,4-D on Nemaha oats at the jointing stage. Keyser, H. R. and Sand, P. F. Six replications of 4 x 12 ft. plots of Nemaha oats were treated with 1/2 lb/A of isopropyl ester of 2,4-D, iso-octyl ester of 2,4-D, propylene glycol butyl ether ester of 2,4-D, butoxy ethanol ester of 2,4-D, butoxy polyethoxy propanol ester of 2,4-D. The chemicals were applied May 26 when the oats were 6 - 8 in. tall and were in the jointing stage, a susceptible stage of growth. All chemicals gave highly significant reductions in yields from the check, however, there were no significant differences in yields between chemicals. (Contribution of the Department of Agronomy, College of Agriculture, Lincoln, Nebraska.)

A comparative test of low volatile esters and MCP salts against common 2,4-D formulations on oats. Pavlychenko, T. K., Bestrop, A. J. In a stubble crop of oats (Avena sativa) on clay loam soil at Rosthern, Saskatchewan, 2 1/2 acre plots were treated when 9 to 10 in. high with butoxy ethanol ester of 2,4-D (Weedone LV4, 3, 5, and 8 oz/A), butoxy ethanol ester of MCP (ACP 904, 3, 6, and 10 oz/A), amine salt of MCP (Weedar MCP, 4, 8, and 12 oz/A) to compare with ethyl ester of 2,4-D (Weedone Concentrate, 3, 5, and 8 oz/A) and amine salt of 2,4-D (Weedar 80, 4, 8, and 12 oz/A). The plots were infested with stinkweed (Thlaspi arvense), Russian thistle (Salsola kali) and wild buckwheat (Polygonum convolvulus). Results: In this test the weeds were fairly advanced at the time of treatment. For this reason the lowest rates were rather uniformly ineffective on weeds and gave yields almost identical to that of the checks. In contrast, the highest rates gave a good kill of weeds and produced economically significant increases in yield, up to 8.6 bu/A, with the exception of MCP ester. Of the 5 chemicals tested, ethyl ester of 2,4-D (Weedone Concentrate) was the only material that caused a 3 day delay in maturity of the crop. The other chemicals, including butoxy ethanol ester of 2,4-D were quite tolerant to the crop even at the higher rates, and did not produce any observable adverse effect on it's development. (Contributed by Agricultural Division, American Chemical Paint Company, Saskatoon, Saskatchewan.)

Herbicides on oats undersown with legumes. Santelmann, P. W. and Willard, C. J. Alfalfa and red clover were sown with 6 pecks Clinton oats at 10 lb/A of alfalfa and 4 lb/A of red clover on March 31, 1953, in plots 7 ft. x 40 ft. Turnips were sown with them to simulate broad-leaved weeds in the small grain. They were treated at three stages: Stage A - three days after seeding (April 3); Stage B - when the oats had about three true leaves and had not formed a canopy (May 14); Stage C - when the oats had formed a canopy over the legumes (June 3). 2,4-D and MCP were applied in ten gellons of solution per acre, all other herbicides at forty gallons per acre. The herbicides used and the results obtained were: MCP, amine salt, at 1/8, 1/4, 1/2, and 1 lb/A, and 2,4-D, amine salt, at 1/8, 1/4, and 1/2 lb/A, used at the B and C stages only, gave very similar results at all rates. Better legume stands followed treatment with both herbicides than in the check plots, and on almost all plots 80 to 100 per cent of the turnips were killed. Only the 2,4-D's at 1/8 lb/A, B stage, gave considerably better oat yields than the untreated checks. The injurious effects of the herbicides were usually more pronounced on the legumes at the C stage but on the turnips at the B stage. The polypropylene glycol butyl ether ester of 2,4-D was used at 1/8 and 1/2 lb/A at the B and C stages. One-eighth lb. did not damage the legumes or the oats and killed the turnips, but the 1/2 lb. rate was injurious at both stages. Chloro-IPC at 3 lb/A,

A stage, killed most of the turnips without harming the oats or legumes. DNBP (Premerge) at 1 lb/A, B stage, gave seventy per cent control of turnips with no oats damage and a good stand of legumes. At the C stage the legumes were injured slightly. TCA at 5 and 10 lb/A at A stage resulted in an almost complete kill of both oats and legumes with no damage to turnips. (Contribution of Ohio Agricultural Experiment Station.)

(Received late)

The reaction of oats to 2,4-D and MCP at 17 stages of growth. McCurdy, E. V. A 2,4-D butyl ester at 1/4 lb/A, 2,4-D amine at 1/2 lb/A, MCP butyl ester at 1/4 lb/A and MCP amine at 1/2 lb/A were sprayed on oats at 3-day intervals. Exeter oats were sown on May 20 on relatively weed free ground. The first treatment was made on June 8 when the oats were 3 inches high and just starting in the 2-leaf stage. The last treatment (17th) was on July 30 when the oats were fully headed and 40 inches tall. Further treatments could not be applied because the crop had lodged and there was the possibility of mechanical injury by the sprayer interfering with the accuracy of the test. The treatments did not result in any deformities of the stems or panicles and there did not appear to be more sterile florets in the treated plots than in the checks. In no case was there a significant increase in yield but there was a significant reduction in yield with the ester of 2,4-D at 1/4 lb/A and the ester of MCP at 1/4 lb/A on the second date of application when the oats were still in the seedling stage. The next significant reduction was with the ester of 2,4-D when applied on the 5th and 6th dates and with the amine of 2,4-D at 8 oz/A on the 6th and 7th dates. The injury at this stage was the most severe and occurred during the period from June 19 to the 29th when the oats were from 8 to 12 inches high. Following this period there was not a significant decrease in yield until the 15th date, then at the 15th date the yield was significantly reduced with the 4 oz. application of the ester of 2,4-D. On the 16th date the 4 oz. of the ester of MCP and on the 17th date the 8 oz. of the amine of MCP also caused significant reductions in yield. These dates included a period from the commencement of heading through flowering, until the plants were fully headed. The yield of the checks averaged 102.7 bu/A and the lowest average yield in the whole test was 85.3 bu/A. Most of the decreases were barely significant. (Contributed by the Dominion Experimental Farm, Indian Head, Saskatchewan.)

Barley

A comparative test of low volatile esters and MCP salts against common 2,4-D formulations on barley. Pavlychenko, T. K., Bestrop, A. J. Replicated plots of barley (Hordeum vulgare) on clay loam soil were treated when the crop was 6 in. high with butoxy ethanol ester of 2,4-D (Weedone LV4, 3, 5, and 8 oz/A), butoxy ethanol ester of MCP (ACP 904, 3, 6, and 10 oz/A), amine salt of MCP (Weedar MCP, 4, 8, 12 oz/A) and sodium salt of MCP (Methoxone, 4, 8, and 12 oz/A) to compare with ethyl ester of 2,4-D (Weedone Concentrate, 3, 5, and 8 oz/A), amine salt of 2,4-D (Weedar 80, 4, 8, and 12 oz/A), acid of 2,4-D (ACP 638, 3, 5, and 8 oz/A), ester of para (ACP 903) and amine of para (ACP 423) both at 3, 6, and 10 oz/A. The crop was heavily infested with stinkweed (Thlaspi arvense), Russian thistle (Salsola kali) and Russian pigweed (Axyris amaranthoides). The midsummer moisture was abnormally low. Results: At the time of treatment the weeds were small and all the chemicals gave highly significant weed control (72 to 93 per cent) as indicated by dry weights. Only

Methoxone at 8 oz/A was less effective (57 per cent). Only slight delay in maturity (1 to 2 days) was recorded in the great majority of the treatments. Out of the 30 serial treatments, 26 produced agronomically significant increases in yield, ranging from 1.1 to 12.3 bu/A. Of four other serial treatments, two gave only slight increases (LV4, 3 oz/A, 0.9 bu/A, and Methoxone, 12 oz/A, 0.7 bu/A), and the remaining two, ester of para, 8 and 12 oz/A, produced decreases of 1.4 and 0.8 bu/A respectively. In this test barley showed sufficient resistance to all the chemicals used excepting ester of para. (Contributed by Agricultural Division, American Chemical Paint Company, Saskatoon, Saskatchewan.)

Data

Chem. Rate oz/A	Reduc. dry wt. weeds %	Grain yield increase bu/A	Chem. Rate oz/A	Reduc. dry wt. weeds %	Grain yield increase bu/A
LV4, 3	76	0.7	W.C., 3	90	10.4
LV4, 5	91	5.2	W.C., 5	95	6.4
LV4, 8	92	9.3	W.C., 8	92	6.7
ACP 904, 3	89	6.0	ACP 903, 4	91	1.7
ACP 904, 6	72	3.1	ACP 903, 8	90	-1.4
ACP 904, 10	90	6.5	ACP 903, 12	80	-0.8
MCP, 4	92	7.0	W80, 4	91	11.8
MCP, 8	91	6.0	W 80, 8	93	5.3
MCP, 12	84	2.5	W 80, 12	90	10.5
MCP 60, 4	88	6.4	ACP 423, 4	89	1.8
MCP 60, 8	78	4.9	ACP 423, 8	82	1.1
MCP 60, 12	93	2.9	ACP 423, 12	83	5.5
Meth., 4	83	8.1	ACP 638, 3	89	5.2
Meth., 8	57	2.9	ACP 638, 5	86	12.3
Meth., 12	88	0.9	ACP 638, 8	85	7.4

Note: LV4 - butoxy ethanol ester of 2,4-D; ACP 904 - ester of MCP; MCP and MCP 60 - amine salts of MCP; Methoxone - sodium salt of MCP; W.C. - ethyl ester of 2,4-D; ACP 903 - ester of para; W 80 - amine salt of 2,4-D; ACP 423 - amine salt of para; ACP 638 - emulsifiable acid of 2,4-D.

FLAX

Summary

R. G. Robinson

As in previous years, MCP was generally reported less damaging to flax than 2,4-D. MCP was reported in one abstract to be less effective than 2,4-D at equivalent rates in controlling stinkweed, Russian thistle, and Russian pigweed in flax. A low volatile, butoxy ethanol ester of 2,4-D and a volatile ethyl ester of 2,4-D were equally effective on weeds, but the former was considerably less injurious to flax. Butyl ester, amine, or sodium salt formulations of MCP did not differ in effect on flax, however, one report indicated the sodium salt was more effective on wild mustard.

Neither 3,4-D nor 2,4,5-T was as effective on weeds in flax as 2,4-D or MCP.

Flaxseed harvested from flax sprayed between the 10% boll set and white seed stages with 5 oz/A MCP germinated less than seed from unsprayed plants. Yields were greatly reduced from spraying at the 10% boll set stage.

Addition of chemical fertilizers to 2,4-D sprays gave better control of Russian thistle and more flax injury than 2,4-D alone according to an abstract published in the annual weed section of this report.

As in previous years, results generally indicate that TCA applications should be approximately 5 lb/A considering both pigeon grass control and possible reductions in flaxseed and straw yields. One abstract indicated slightly more damage to flax from a liquid than from a dry TCA formulation. A mixture of 2,4-D or MCP and TCA was generally more toxic to weeds and flax than either chemical alone.

Several abstracts dealt with CMU and none reported injury to flax, however, in other trials not reported this year CMU at 1 to 3 lb/A damaged flax severely. Weed control varied from good to poor.

Neither CMU nor Urab was effective on wild oats in 3 of 4 trials. Urab reduced flax yield in the trial where it gave partial control of wild oats. Dalapon at 2 1/2 lb/A in one trial gave 60% control of wild oats and no reduction in flax yield.

One abstract on pre-emergence weed control in sesame and safflower is included with the flax abstracts.

Abstracts

Control of weeds in flax. Brown, D. A. The Rocket variety of flax was treated in 1953 when plants were three inches high and weeds in early seedling stages. Treatments included 2,4-D butyl ester, amine, and sodium salt, MCP butyl ester (methoxone 5) amine and sodium salt (methoxone 3) all at 1.5, 3, 5, and 8 oz. acid equivalent per acre. TCA was applied at 2.5, 5, 8 and 15 lb and CMU at .5, 2 and 3 lb active ingredient per acre. In addition, 5 lb of TCA and 1.5 lb of CMU were applied, each in combination with 5 oz of MCP amine per acre. Weeds prevalent in the crop were green foxtail, Russian thistle, common buckwheat, stinkweed, lamb's quarters and red root pigweed.

Volunteer wheat and barley appeared over the entire plot area. Rainfall was heavy several days before and after treatment and permanent damage occurred by flood water on one-fifth of the area. Threshed yields revealed no statistically significant differences between treatments, rates of treatments, and between checks and treatments times rates. This differed from the previous year when CMU at 2 and 3 lb, TCA at 10 and 15 lb, and 2,4-D ester at 5 and 8 oz damaged the flax plants sufficiently to significantly reduce the yield. Differences in 1953 in terms of weed kill were however, significant. TCA at 3 lb upwards killed green foxtail 80 to 100%. CMU at 2 and 3 lb gave equal results. TCA at 15 lb and CMU at 3 lb killed 90% of the volunteer barley and wheat. The hormone compounds up to the 3 oz rate gave unsatisfactory weed kill and threshed yields of flax tended to be lighter from the lower than the higher rates indicating that heavy weed competition on the former tended to depress yield. The 2,4-D and MCP formulations gave equal results. The most effective weed control treatment was obtained by combining MCP amine with TCA or CMU. (Contribution from Canada Experimental Farm, Brandon, Manitoba.)

Effects of post-emergence application of TCA and TCA with 2,4-D on fibre flax. Chubb, W. O. and E. M. Mackey. Weed free Liral Dominion flax was sprayed when 3 to 5 inches tall with 5 and 10 lb acid equivalent/A of TCA (sodium salt) alone and with 3 oz acid equivalent/A of 2,4-D triethanolamine salt, and with 3 oz/A of 2,4-D alone. An untreated check was also included. Total spray liquid was 11.5 gal (Imp.)/A. Treatments were carried out in triplicate. Plot size was 1/160A. The deseeded flax straw was water retted for extraction of the fibre. Although the treatment with 10 lb/A TCA combined with 3 oz/A 2,4-D was the only one which significantly reduced the yields of seed, straw, total fibre, line fibre and the proportion of total fibre obtained as line fibre below the checks, there appeared to be a fairly regular trend for yields from the treatments with TCA and 2,4-D to be lower than from the treatments with TCA alone. The mean yields are given in the table below:

	Yield per acre				
Treatment	Seed (bu)	Deseeded straw (lbs)	Total fibre (lbs)	Line fibre (lbs)	Line yield as % total fibre extracted
Untreated check	17.1	4480	670	300	42.9
5 lb/A TCA	17.3	4320	632	286	44.3
10 lb/A TCA	15.5	4080	621	268	43.0
5 lb/A TCA plus 3 oz/A 2,4-D	16.8	4240	617	258	41.1
10 lb/A TCA plus 3 oz/A 2,4-D	14.8	3760	561	183	32.3
LSD (P = 0.05)	1.7	480	83	85	6.8

(Contribution of the Dominion Pilot Flax Mill, Division of Field Husbandry, Experimental Farms Service, Portage la Prairie, Manitoba. Approved for publication).

The effect of chemical herbicides on flax 1953. Dawley, W. K. Redwood flax, seeded in replicated rod-row plots, was sprayed at two separate stages of growth, namely two and six inches tall. A split plot randomized block design was used. Check plots were left untreated. The test was not weeded until harvest. Such weeds as Setaria viridis, Chenopodium album and Salsola kali were found uniformly throughout the plot area.

Significant increases in yield at the 5% level were obtained from plots treated with 2,4-D amine at 5 oz acid/A and from those treated with CMU at 1 1/2 lb/A. TCA at rates of 5, 10 and 15 lb/A and TCA at 5 lb in combination with MCP amine at 5 oz acid/A significantly decreased the yield of flaxseed. In the interaction of herbicides by stages of growth, the only significant increase in yield was obtained from the application of CMU at the two inch stage. TCA at all rates of application and in combination with MCP amine significantly reduced yield at both growth stages. There was evidence, however, that toxicity of flax to TCA was higher at the 2 than the 6 inch stage. (Contribution from the Dominion Reclamation Station, Melita, Manitoba.)

Effects of herbicides on Marine flax and annual weed yields. Derscheid, Lyle A. Four experiments were conducted in 1953. All chemicals were applied in 13 gal/A of spray solution when the flax was 3 in. tall, foxtail 1 in tall, and broadleaved weeds were emerging.

Experiment I. - Triplicate 4-row x 15 ft plots were treated with 1/8 or 1/4 lb/A of 2,4-D amine or 2,4,5-T amine or 1/8, 1/4, or 3/8 lb/A of MCP amine (60% 2-methyl-4-chloro) MCP amine (85% 2-methyl-4-chloro) MCP ester, MCP sodium salt, 3-4 dichlorophenoxyacetic (3,4-D) amine, or 3,4-D ester, or 5 or 7 1/2 lb/A of liquid TCA sodium salt or powdered TCA sodium salt or with mixtures of 2,4-D or MCP and TCA at rates of 1/8 or 1/4 lb/A of 2,4-D or MCP and 3 or 5 lb/A of TCA. The two middle rows were treated, harvested and the data analyzed statistically. Yields were significantly decreased by application of 1/4 or 3/8 lb/A of 3,4-D ester, by 7 1/2 lb/A of powdered TCA, by 5 or 7 1/2 lb/A of liquid TCA and by a mixture of 1/4 lb/A of 2,4-D and 5 lb/A of TCA.

Experiment II. - Triplicate 5- x 15 ft plots were seeded to a mixture of foxtail, mustard, lamb's quarters, and kochia. All treatments applied in Experiment I were applied except the 5 or 7 1/2 lb/A of liquid and powdered TCA. Flax was harvested from 2 x 12 ft area and weeds were harvested from 1 1/2 x 12 ft areas. Weeds were dried and pounds of dry matter per acre determined. Flax yields were analyzed statistically. The two higher rates of 3,4-D ester caused a significant decrease in yield, but none of the treated plots outyielded the untreated weedy check. However, good stands of flax were able to compete effectively against weeds this year and weed yields were low, especially of the broadleaved species. 3,4-D amine, 2,4,5-T amine and 1/8 lb/A of MCP amine and sodium salt gave poorest control of broadleaved weeds. 2,4-D or MCP and TCA mixtures reduced yields of foxtail 50% but removed practically all competition of the weed until after flax was in the boll. These mixtures also controlled broadleaved weeds except when only 1/8 lb/A of MCP was in the mixture.

Experiment III. - Triplicate 5 x 15 ft plots containing the broadleaved weeds used in Experiment II were treated with 1/4 lb/A of the phenoxyacetic acid compounds while plots containing foxtail were treated with 5 or 7 1/2 lb/A of liquid or powdered TCA. Yields of flax and weeds were obtained on a 2 x 12 ft and 1 1/2 x 12 ft areas, respectively. Yields from treated plots were not significantly different from those of untreated weedy check plots, but lowest yields were on plots treated with parachlorophenoxyacetic acid or 7 1/2 lb/A of liquid TCA.

Experiment IV. - Single 1 x 5 rd plots were treated with 1/4 lb/A of each of the phenoxyacetic acid compounds used in Experiment I or with 3 mixtures containing 1/4 lb/A MCP and 5 lb/A TCA applied separately, applied together, or as a commercial mixture. Yields were taken on a 700 sq ft area. MCP did not delay flowering but 2,4-D, TCA and MCP-TCA mixtures delayed it 4-5 days, parachloro delayed it one week and 3,4-D and 2,4,5-T delayed it 10 days. 3,4-D parachloro and 2,4,5-T gave unsatisfactory broadleaved weed control and delayed growth of flax until foxtail took over. 2,4-D and MCP plots outyielded untreated plots 5 and 6 bu/A while lowest yield and highest dockage were on plots treated with 2,4,5-T, 3,4-D, MCP-TCA mixtures in order.

These data indicate that MCP amine is less toxic to flax especially when used in a mixture with TCA. 2,4-D and TCA tend to delay growth a few days. MCP and 2,4-D are more effective for controlling weeds than the other phenoxyacetic acid compounds. It appears that less TCA may be needed to control foxtail if used in a mixture with 2,4-D or MCP than when used alone. (Contributed by the Agronomy Department, South Dakota Agricultural Experiment Station, College Station, South Dakota. Approved for publication.)

Late spraying of Redwood flax. Dunham, R. S. and Robinson, R. G. The following table summarizes the results of spraying weed-free plots with 5 oz MCP, alkanolamine, per acre at St. Paul, Minnesota.

Time of spraying		Flax seed	
Date	Stage	Yield, bu.	Germination, %
Unsprayed		18.2	70
6/26	Full bloom	17.0	68
7/1	10% boll-set	7.5	58
7/6	Over 75% boll-set	16.9	63
7/10	Seeds white *	17.8	64
7/24	Seeds brown	19.5	69
LSD 5%		4.5	6

Stages were significantly different in seed yield and germination at the 1% level.

* At this stage there was still 3-5% bloom on these plants which may account for the lowered germination. (Contribution from the Department of Agronomy and Plant Genetics, University of Minnesota; St. Paul, Minn. Paper No. 3070 Sci. Jour. Series, Minn. Agric. Exp. Station.)

Comparison of MCP formulations on flax and wild mustard. Dunham, R. S. and Robinson, R. G. A sodium salt and an alkanolamine salt of MCP were compared in 1952 and 1953 at St. Paul. In 1953 a butyl ester was included. At 4 and 8 oz rates there was no consistent difference between formulations in effect on flax. The sodium salt gave slightly better control of wild mustard than the amine or ester which were about equal in effectiveness. Mustard control was satisfactory with all formulations at 2 or 4 oz/A. (Contribution from the Department of Agronomy and Plant Genetics, University of Minnesota; St. Paul, Minn. Paper No. 3073 Sci. Jour. Series, Minn. Agric. Exp. Station.)

Post-emergence application of CMU at four locations, one each in S. Dak. and Minn. and two in N. Dak. to control wild oats in flax. MacDonald, W. P., Zinter, C. C., Slough, A. T. 3-p-chlorophenyl-1-1-dimethylurea (CMU) was applied at 3, 1 1/2 and 3/4 lb active ingredient/A with 20 gal of water as a selective spray in B5128, Minerva and Marine flax. Flax 2-5 in., wild oats and Setaria spp. 2-6 in. in height. At one location, CMU at 3 lb gave 65% control; 1 1/2 lb 25% control; 3/4 lb zero control of wild oats with no reduction in flax yield at any rate. Setaria spp. control excellent at 3 lb and 1 1/2 lb rates. At the other 3 locations, CMU gave no practical weed control or injury to flax at any rate. (Contribution of Agr. Dept., F. H. Peavey and Co., Minneapolis, Minn.)

Post-emergence application of Urab at four locations, one each in S. Dak. and Minn. and two in N. Dak. to control wild oats in flax. MacDonald, W. P., Zinter, C. C., Slough, A. T. Phenyldimethyl urea (Urab) was applied at 3, 1 1/2, and 3/4 lb active ingredient/A with 20 gal of water as a selective spray in B5128, Minerva and Marine flax. Flax 2-5 in. high, wild oats and Setaria spp. 2-6 in. in height. At one location, Urab at 3 lb gave 75% control, at 1 1/2 lb 40% control with significant reduction in yield of flax. At the other three locations, Urab gave no practical weed control or noticeable injury to flax at any rate. (Contribution of Agr. Dept., F. H. Peavey and Co., Minneapolis, Minn.)

Post-emergence application of Dalapon in 1953 at Nielsville, Minn. to control wild oats in Minerva flax. MacDonald, W. P., Zinter, C. C., Slough, A. T., Zuhl, H. A. The Dalapon sodium salt formulation (equivalent to 64-68% alpha, alpha, dichloropropionic acid) was applied at 10 and 5 lb. of product/A and at 10, 5, and 2 1/2 lb of product with wetting agent (Dreft) at .001 conc.; 10 gal of water solution was applied with all rates on flax as a post-emergence spray for wild oats control. Wild oats was 4-6 in high, flax 3-5 in. Plots were triplicated and randomized. Most flax plots showed effect of Dalapon for week to ten days after spraying. The 5 and 10 lb rates of Dalapon with and without wetting agent gave 90% or better control of wild oats with a significant reduction in yield of flax. The 2 1/2 rate with wetting agent gave 60% control with no loss in yield. All rates gave excellent control of Setaria spp. Malformation of flax roots noted at all rates. (Contribution of F. H. Peavey and Co., Minneapolis, Minn. and Dow Chemical Co., Midland, Mich.)

A comparative test of MCP formulations and low volatile butoxy ethanol ester of 2,4-D against other systemic herbicides on flax. Pavlychenko, T. K., Bestrop, A. J. Replicated plots of flax at 4-leaf stage were treated with 2, 4 and 6 oz/A rates of butoxy ethanol ester of 2,4-D (Weedone LV4), 3, 5 and 8 oz/A of butoxy ethanol ester of MCP (ACP 904), amine salts of MCP (Weedar MCP and Weedar MCP 60) and sodium salt of MCP (Methoxone) to compare with 2, 4 and 6 oz/A of ethyl ester (Weedone Concentrate), and acid of 2,4-D (ACP 638), 3, 5 and 8 oz/A of amine of 2,4-D (Weedar 80), ester (ACP 903) and amine (ACP 423) of para. The crop was heavily infested with stinkweed (Thlaspi arvense), Russian thistle (Salsola kali) and Russian pigweed (Axyris amaranthoides). The soil was clay loam and the midsummer moisture abnormally low.

Results: The results from this replicated comparative test illustrate several points of importance: 1. At equivalent rates, all MCP formulations were more tolerant to flax and less effective on weeds than similar formulations of 2,4-D. 2. The low volatile butoxy ethanol ester of 2,4-D was considerably more tolerant to flax and equally effective on weeds as the volatile ester of 2,4-D (Weedone Concentrate).

3. The lowest rates of all the chemicals used, excepting ethyl ester, were inadequate for good weed control, while the highest rates of all formulations were too severe on flax. The medium rates used gave a good control of weeds and produced the best yields. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Chemical control of lady's thumb smartweed in B5128 flax. Robinson, R. G. and Dunham, R. S. The usual applications of MCP, 2,4-D, and TCA generally do not control smartweed satisfactorily. Screening trials showed potassium cyanate, Ammate, CMU, D, M, and endothal to be more specific for this weed. Applications of M at 2 or 3 lb or Ammate at 20 lb to flax 12 inches tall and smartweed 6 inches tall were satisfactory. Endothal at 1 lb was too injurious to flax. Potassium cyanate, even at 15 lb did not control smartweed satisfactorily when applied at this stage. (Contribution from the Department of Agronomy and Plant Genetics, University of Minnesota; St. Paul, Minn. Paper No. 3074 Sci. Jour. Series, Minn. Agric. Exp. Station.)

Pre-emergence weed control in sesame and safflower. Williams, J. H. and Sand, Paul. Sesame N68-1 was planted on June 2 at Lincoln on a silty clay loam soil. The experimental design was a randomized block in triplicate. Three 40-inch row plots, 20 ft long were treated June 5, one day before emergence. All herbicides were applied in 40 gal water. On July 8 all plots were cultivated. The sesame stand was not thinned, consequently, some treatments that resulted in high per cent kill of sesame served to thin stand and higher than normal yields resulted. CIPC, CMU and Phenyldimethylurea affected sesame the least and resulted in yields not significantly different than the hand weeded check.

A similar study with N8 safflower was planted on April 17. Treatments were similar to those used with sesame and were applied 6 days after planting. Estimates of weed control and damage to safflower are shown in the table. CMU and CIPC AT 4 lb/A were the only treatments that did not seriously damage the safflower.

		Sesame			Safffflower	
Treatment	Rate lb/A	% Weed control	% Kill Sesame	Yields lb/A	% Weed control	% Kill Safflower
*Dow Premerge	6	83	70	512	76	80
Dow Premerge	8	87	95	-	85	94
Dow Premerge	12	92	99	-	87	98
Phenyldimethylurea	2	68	15	795	84	74
CMU	2	80	7	855	82	14
CIPC	4	67	7	781	50	16
CIPC	8	87	10	794	86	86
CIPC	16	88	13	909	91	70
**Alanap-1	8	53	46	713	---	---
Micronized 2,4-D acid	2	---	---	-	68	90
Weedone 638 (2,4-D)	2	75	87	430	63	93
2,4-D triethanolamine	2	70	93	367	76	94
2,4-D Ethyl sulfate	2	40	73	471	59	88
Handweeded	-	100	0	803	100	0
No weed control	-	0	0	398	0	0

* Dow premerge - dinitro-o-sec-butyl phenol.
** Alanap-1 N-1 napthyl phthalamic acid

(Contribution of Department of Agronomy, College of Agriculture, Lincoln, Nebraska.

CORN

Summary

D. W. Staniforth

Eight stations contributed a total of fifteen abstracts. Approximately one-third of the abstracts compared several pre-emergence herbicides with 2,4-D. Results with 2,4-D added little new to the recommendations for its use in corn, although one station reported no satisfactory weed control with pre-emergence rates of 2,4-D applied before or shortly after corn emergence. One station reported 2,4-D pre-emergence sprays applied in 10 inch bands over the rows of corn, as effective as overalll applications when the treatments were supplemented with timely cultivation. Among other herbicides tested in pre-emergence trials, DNBP, CMU, PDU, SES, Sesin, NaPCP and MCP showed considerable promise. Yield data were not available but injury to corn appeared slight in most tests. Natrin did not control annual grasses in two experiments. CIPC gave good control of annual grass in one test. One station reported good control of giant foxtail with 12-18 lb./A of DNBP; sweet corn and popcorn stands were reduced by such treatments while dent corn stands were not. Successful use over a four-year period, of TCA plus 2,4-D as a layby spray for corn was reported by one station.

Five stations presented results from the use of DNBP as a post-emergence spray. In general, good control of annual weeds including grasses was obtained with 3-7 lb./A of DNBP. Leaf burn and stunting of corn was most severe with heavier rates and particularly at the 4-8 leaf stages of corn growth. Timing and rate appear critical with this treatment, but the promising results, particularly in annual grass control, warrant further investigations.

A third group of interesting abstracts provided new and additional information concerning the reactions of corn to herbicides. Genetics of 2,4-D injury to corn, problems of corn stalk succulence and breakage as influenced by 2,4-D treatments, varietal responses of corn to CMU and pre-harvest sprays for corn were included. Additional data were presented regarding the severity of 2,4-D injury, from treatments applied at several growth stages of corn.

Abstracts

Effect of 2,4-D on dry matter content of stalks of corn inbreds. Behrens, R., Buchholtz, K. P. The breakage of corn stalks following treatment with 2,4-D suggested that the tissues of treated plants may have become more succulent. Experiments were completed in 1950 and 1951 to test this hypothesis. In 1950 corn inbreds 375 (susceptible to 2,4-D) and M-14 (resistant to 2,4-D) were treated with an alkanolamine salt preparation of 2,4-D at rates of 0.0, 0.5, 1.0 and 2.0 lbs of 2,4-D acid equivalent per acre. Water equal to 20 gal/A was used and treatments were applied when the 5th and 6th internodes of most plants had started to elongate rapidly. Samples of stalk tissue for determination of dry matter were collected from plants selected at random 4,8 and 16 days after treatment. No apparent difference was found in the dry matter contents of treated an untreated plants within an inbred regardless of the rate of application. Eight days after treatment stalks of treated plants averaged 13.1 pct dry matter while those of untreated plants averaged 13.2.

Similar tests were completed in 1951 using inbreds 22, 23, 374, 375 and M-14. They were treated with 0.0 and 1.0 lb. per acre of 2,4-D acid equivalent applied as the triethanolamine salt. Samples were collected 14 days

after treatment. As in 1950 there was no significant difference in the mean dry matter contents of treated and untreated samples of the inbreds. The average dry matter contents for treated and untreated samples over all inbreds was 11.2 and 10.9 pct respectively. These results indicate that 2,4-D treatments do not give an increase in succulence as might be expected from the stalk bending and breakage which occur after treatment with 2,4-D. (Contribution from the Dept. of Agronomy, Univ. of Wisc., Madison, Wisconsin.)

Varietal response of corn to CMU. Buchholtz, K. P. A preliminary trial in 1952 indicated that corn inbreds differed in their tolerance of CMU when applied at the lay-by stage. On May 29, 1953, five inbreds and one double hybrid were planted in single rows 30 ft. long using a split plot design and 4 replications. On may 30 one series of plots was treated with CMU at 2 lbs/A using water equivalent of 40 gals/A. At lay-by time on July 28 an additional series of plots was treated with CMU at 2 lbs/A using nozzles adjusted to cover the soil surface. Only the lower leaves and lower 6 in of the corn stalks were contacted by the spray. A third series of plots was not treated with CMU. The area was cultivated 3 times during June and early July. The first cultivation was delayed so that a slight amount of weed competition developed on plots not given the pre-emergence treatment.

Data was obtained on plant stand on June 15, on plant height on July 13, and on grain dry matter content, ear number per plant and grain yield at harvest time. An analysis of the data showed that plant stands were not affected by the pre-emergence application of CMU. Height measurements indicated that the pre-emergence treatment did not cause a differential response during the early growth stages. Ear number per plant and dry matter content of the grain did not vary significantly from check for any of the varieties studies. Grain yields did vary significantly, however. Results are summarized in the table.

Variety	Check	Pre-emergence	Lay-by
416AA	77.0 Bu/A	91.3* Bu/A	71.4 Bu/A
17RB	43.4	46.3	44.2
22RB	52.4	48.2	40.9*
M13R	27.4	24.4	16.0*
182R	30.5	35.5	34.1
153R	37.8	52.7*	33.9

*Sig. different from check at the 5% level.

Hybrid 416AA and inbred 153R yeilded significantly more on the plots treated pre-emergence than on check plots or those treated at lay-by. This may indicate that these varieties are more sensitive to weed competition or that they are more tolerant of CMU than the other varieties. Yields of inbreds M13R and 22RB were significantly less on plots treated at the lay-by stage than on check plots or plots treated at the earlier date. Weed control on the plots treated at lay-by was the same as on the check plots during the early part of the season and better following the latter treatment. Therefore it can be concluded that inbreds M13R and 22RB are more sensitive to CMU than the other varieties. This agrees with observations made in 1952. (Dept. of Agron., Univ. of Wis., Madison, Wisconsin)

Results of genetic studies of a type of 2,4-D injury in corn. Clary, Gerald. Preliminary observations of germinating seeds of various popcorn and dent corn inbreds in 2,4-D solutions at concentrations from 50 to 500 ppm indicated that the popcorn inbreds tested differed strikingly from the dent corn inbred C-20 in their reaction to 2,4-D. This difference was apparent in the degree of tissue proliferation in the seedlings. C-20 exhibited a large amount of tissue proliferation while the popcorn inbreds tested showed little or none. The F_1 of crosses between C-20 and these inbreds likewise showed less tissue proliferation than C-20. A series of homozygous reciprocal translocations induced by X-ray treatment of C-20 were available as were crosses between the translocations and two popcorn inbreds, Sg 18 and Iowa 28. These translocations involve 11 of the 20 chromosome arms. The F_2 generation of crosses between the translocations and the popcorn inbreds, the three parents, and the F_1 combinations of the dent and popcorn inbreds were planted in the field and treated with 1.5 lbs/A of the ester of 2,4-D. Plants were treated at the 10-14 leaf stage. Five days after treatment, C-20 exhibited a high degree of stalk curvature and leaf rolling. Neither Sg-18 and I-28 showed these symptoms of injury to such a degree, although a few plants showed some curvature and were recorded as susceptible to this type of 2,4-D injury. The reaction to 2,4-D of the crosses not involving the translocations are shown in the table below.

Susceptible plants recorded as percent of total plants tested.

	Sg-18	Iowa-28	C-20
Sg-18	7	-	73
Iowa-28	-	11	80
C-20	73	80	67

The data for the crosses involving the translocations have not been completely analysed but incomplete results indicate that some popcorn lines have loci governing resistance to the type of 2,4-D injury noted. It may be possible to determine the number and position of these loci by means of translocations. (Department of Botany and Plant Pathology, Purdue University, Lafayette, Indiana.)

A comparison of herbicides for pre-emergence weed control in corn. Fletchall, O. Hale. The corn was planted and five herbicides applied May 15, 1953 in triplicated plots. On June 2 the extended-leaf height of corn on the check was 9 inches and it contained the following numbers of weeds per square foot: 62 crabgrass (Digitaria spp.), 69 foxtail (Setaria spp.), and 18 broad-leaved weeds consisting mostly of carpetweed (Mollugo verticillata L.), prickly mallow (Sida Spinosa L.), purslane (Portulaca oleracea L.), Korean Lespedeza Lespedeza stipulacea Maxim.), and velvet leaf (Abutilon theophrasti Medic.). Following are the results:

Herbicide	Pounds/ Acre	% control of crabgrass	% control of foxtail	% control of broad-leaved weeds	%reduction in height of corn
2,4-D amine	1	66	79	80	12
2,4-D amine	2	87	83	88	27
2,4-D ester	1	55	85	82	9
2,4-D ester	2	69	83	82	18
DNOSBP amine	3	37	80	94	16
DNOSBP amine	6	67	94	94	13
CMU	3/4	69	87	97	11
CMU	1 1/2	98	99	99	14
phenyldimethylurea	3/4	38	50	96	15
phenyldimethylurea	1 1/2	63	64	93	13

(Contribution from the Missouri Agricultural Experiment Station.)

Pre-harvest sprays on corn. Ham, G. F. and Willard, C. J. Sodium cyanamid (Aero cyanamid) at 10, 25, and 40 lb/A, active ingredient, 3,6 endoxohexahydropthalate (Endothal) 1.5, 2 and 2.5 lb/A, active ingredient, and pentachlorophenol, 1, 2, and 4 lb/A active ingredient, were applied in 80 gallons of solution per acre. The corn plots, 13 x 50 ft. were replicated five times. W64 corn, a mid season variety, planted May 5, was treated on September 4, when the moisture content of the grain was 38.8%, and the leaves were still green. Pentachlorophenol killed the leaves most effectively, at all rates. Moisture samples were obtained every three days until September 14, and again on September 21. On September 21, there was 25.8% moisture in the untreated plots. There was never over 2 to 3 percentage points difference between the moisture in the treated and untreated plots. (Contribution of the Ohio Agricultural Experiment Station)

Pre- and post-emergence herbicides on corn. Ilnicki, R. D., Ham, G. F. and Willard, C. J. This experiment was conducted at the Northwestern Substation, Ohio Agricultural Experiment Station, Hoytville, Ohio (Ilnicki). Ohio W64 corn was drilled June 2 in 42 inch rows, on Hoytville clay, and laid out in 4-row triplicated plots. Plots were treated on June 5 with the alkanolamine salt and the polypropylene glycol butyl ether ester of MCP each at 2 and 4 lb/A.; isopropyl N-(3-chlorophenyl)- carbamate (CIPC) at 1, 3, and 6 lb/A.; alkanol amine salt of 4,6-dinitro-ortho-sec.-butyl phenol (DNBP) (Premerge) at 5, 7, and 10 lb/A.; and 3-chlorophenyl)-1, 1-dimethyl-urea (CMU) at 1/2, 1, 2, and 4 lb/A. The following chemicals were applied on June 6: sodium 2,4,5-trichlorophenoxyethyl sulfate (Natrin), 2,4-dichlorophenoxyethyl sulfate (Crag 1) and 2,4-dichlorophenoxyethyl benzoate (Sesin) each at 2 and 4 lb/A.; and 1-phenyl-3,3-dimethyl urea (PDU) at 1/2, 1, 2, and 4 lb/A. On June 9 (coleoptile visible) DNBP was applied at 5,7, and 10 lb/A. One June 13 (2-3 leaves) the following treatments were made: DNBP at 1, 2, 3, 5, and 7 lb/A.; CMU and PDU each at 1/2 and 1 lb/A.; and 3,4-dichlorophenoxyacetic acid (3,4-D) at 1/2, 1, and 2 lb/A. 3,4-D was applied on June 22 (6 leaves) at 1/2, 1, and 2 lb/A, and on June 29 (9 leaves) at 1/2 and 1 lb/A. All rates are expressed as active ingredient and all applied at 40 gallons of spray per acre. Checks with and without cultivation were included. Chemicals giving outstanding weed control were DNBP pre-emergence at 7 and 10 lb/A, DNBP at coleoptile stage at 5,7, and 10 lb/A,; DNBP as early post-emergence treatment at 3,5,and 7 lb/A.; CMU and PDU at 2 and 4 lb/A applied as pre-emergence applications; Crag 1 and both MCP formulations at 2 and 4 lb. rates applied pre-emergence. Of the above mentioned herbicides only the MCP compounds at 4 lb damaged corn, and here the initial stunting was later outgrown. Post-emergence applications of DNBP burned young leaves but this effect did not prove detrimental. CIPC at 6 lb. gave complete control of grasses (Setaria lutescens and Echinochloa crusgalli) with good control of broadleaves. The lower rates were ineffective on all weeds. Natrin was effective on broadleaves and not effective on grasses. Initially corn was stunted by the 4 lb. rate but the effect was outgrown. Sesin at both rates gave excellent control of all weeds and the initial stunting was not long lived. 3,4-D was most effective at all rates when applied as an early post-emergence treatment. Subsequent applications of this compound were only effective on broadleaves at the higher rates. Grasses were not controlled. Corn was not harvested at the date of this report. However it appears that yields will be reduced in those plots where weed control was not effective. Similar, but much less extensive, results were obtained at Columbus (Ham). (Contribution of Ohio Agricultural Experiment Station.)

Critical period for treating corn with 2,4-D. Ilnicki, R. D. and Willard, C. J. This is the second year of an extensive experiment designed to locate critical stages of growth for treatment of corn with 2,4-D, conducted at the Northwestern Substation, Ohio Agricultural Experiment Station, Hoytville, Ohio. Ohio W-64 corn was drilled June 2, in 42-inch rows on Hoytville clay, and triplicate 4-row plots were laid out to be treated with the alkanol amine salt at 1/2, 1, and 2 lb/A (also 4 lb/A first two dates) and the isopropyl ester of 2,4-D at 1/4, 1/2, 1, 2, and 4 lb/A (no 1/4 lb/A on first two dates). These applications were made at approximately 2-day intervals beginning on June 6 and terminating on July 11 for a total of 16 dates of application. All treatments were applied at 10 gallons of spray per acre. Checks with and without cultivation were included. Rainfall during the period of treatment this year was nearly normal, with 3.01 inches during the period June 6 to July 11. The greatest injury resulted from the treatment made at the coleoptile stage and at subsequent stages up to and including the 8-leaf stage (June 24). Injury was most serious when soil moisture was high and treatments were made following periods of high mean daily temperature.. This is the fourth year of careful experiments to locate critical periods, if any, for treating corn with 2,4-D. The stage or stages of greatest injury have been different in each year, and have occurred at every period up to tasseling. It is our belief, as a result of these experiments, that up to the tasseling stage there is no stage of growth which in itself is critical or particularly dangerous for 2,4-D applications. Under proper environmental conditions, especially periods of high temperature and rapid growth, 2,4-D can be seriously injurious at any stage. Future work should be directed to the more accurate determination of the conditions which favor 2,4-D injury. (Contribution of the Ohio Agricultural Experiment Station.)

Tolerance of different types of corn to pre-emergence application of DNBP. Lee, Oliver C. and Clary, Gerald. Sweet corn (KVF 51-180), popcorn (Purdue 202) and two dent corn hybrids, Ind. 620 and Ind. 813, were treated with pre-emergence applications of 12, 14, 16, and 18 lbs/A rates of DNBP. Plots were treated June 25, 24 hours after planting. The corn was planted with a hand planter at a depth of 2 1/2 to 3 inches. A randomized block design with four replications was used. Soil type is Crosby silt loam. Plots were not cultivated. Sweet corn and popcorn appeared more susceptible to injury than the dent corn hybrids. Sweet corn stand was reduced by all rates, the 18 lbs/A rate reduced the stand of popcorn, but no reduction in stand occurred in the dent corn hybrid treated. All rates caused temporary stunting of all the hybrids tested. Weed control was excellent for all rates of DNBP. Giant foxtail (Setaria faberi) was severely retarded by the 12 lbs/A rate and controlled by the heavier rates. (Department of Botany and Plant Pathology, Purdue University, Lafayette, Indiana.)

Post-emergence application of DNBP on corn. Lee, Oliver C. and Clary, Gerald. DNBP was applied at 3 rates on 2 dates to determine tolerance of corn at different stages of growth as well as determine effect on weed growth. Three rates, 1.5, 3.0 and 6.0 lbs/A of DNBP were applied in water equivalent to 50 gal/A. These treatments were applied when the corn was in the 2-3 leaf stage and in the 5-6 leaf stage. Plots were 6.6' x 45'. A randomized block design with four replications was used. The treatments applied when the weeds were less than 1 in. high and the corn was in the 2-3 leaf stage gave excellent weed control. The 3 lb/A rate controlled 90-95% of the weeds and resulted in about 10-20% reduction in stand of corn. The 6.0 lb/A rate gave nearly 100% control of weeds but reduced the stand of corn 40-60%. The 1.5 lb/A rate did not damage the corn, the rate did kill 70-80% of the broad leafed weeds that had germinated but grasses and sedge were not injured.

The treatments applied when the weeds were 2-8 in. high and the corn in the 5-6 leaf stage did not seem practical because of severe injury to the corn. The plots treated with 6.0 lbs/A of DNBP remained free of weeds up to 8 weeks after treatment. The plots treated at the early date at the two heavier rates ramained free of weeds for a period of 3-6 weeks. At the end of this time the plots had comparatively few broad leafed weeds in them but crabgrass (Digiteria ischaemum) and sedge (Carex spp.) reinfested the plots. All treatments caused dwarfing of the corn, but this was temporary and the plants appeared to be completely recovered at time of silking. This test indicates that satisfactory control can be obtained with post-emergence application of DNBP but the rate and time of application is critical. (Department of Botany and Plant Pathology, Purdue University, Lafayette, Indiana.)

A comparison of strip and overall applications of pre-emergence sprays. Lovely, W. G. and Collins, E. V. Corn was hill-dropped on May 9, 1953 in 42" rows on Clarion-Webster soil. On May 14, 2,4-D amine was applied at the rate of 2 lbs. acid equiv/acre in 7 1/2 gal. H_2O. The overall spray application was made by having nozzles equally spaced along the boom and strip application were made by having one nozzle directly over the corn row and angled to cover a 10 1/2 inch strip. These pre-emergence treatments were used in addition to 3 normal cultivations, as a substitute for the normal 1st cultivation, and as a substitute for the 1st and 2nd cultivations. Check plots received 3 normal cultivations. There was practically no variation in the number of stalks per acre between any of the treatments. Weed control and yields were affected. The pre-emergence spray used in addition to 3 normal cultivations applied either in strips of overall gave weed control that was for all practical purposes completely weed-free. Yields on these plots were not increased over the checks. When the 1st cultivation was eliminated the weed control was better than the check plots and yields were equal. The pre-emergence spray was not a successful substitute for the 1st and 2nd cultivations. This treatment gave significantly lower yields and higher weed infestations and the strip application gave poorer weed control and lower yield than the overall application. These results show that applying 2,4-D as a pre-emergence spray in 10 1/2 inch strips directly over the corn row is as effective for controlling weeds as overall applications when the 1st cultivation is eliminated. They also show that the 1st mechanical cultivation can be delayed until the corn is 12" to 15" high if pre-emergence applications of 2,4-D are made. (Contribution of Division of Farm Machinery, Bur. of Plant Ind., Soils, and Agr. Engineering, U. S. Dept. of Agri., and Dept. of Agr. Engineering, Iowa Agri. Exp. Station:)

Pre-emergence and lay-by applications of herbicides on corn. Robinson, R. G. and Dunham, R. S. Pre-emergence applications of 2,4-D during a three year period were made 2,3, and 6 days after planting, when leaf ruptured coleoptile, and 10 days after emergence. Both amines and esters were used during this period and cultivation vs no cultivation following treatment was compared. No satisfactory control of grass weeds has ever been obtained. No injury to corn from 2,4-D has resulted except when applied after emergence at 1 lb. per acre. In these instances yields were reduced over 80%. Pre-emergence applications plus 2 cultivations gave no better weed control than 4 cultivations and yielded significantly less corn. CMU at 1 and 2 lbs. was the most promising herbicide tested for pre-emergence use on corn but it, too, has been undependable.

Lay-by applications of TCA plus 2,4-D over a 4-year period have resulted in good weed control with no reduction in corn yield and in one year a highly significant increase. A generally successful rate is 5 lb. TCA plus 1 lb. 2,4-D applied below the leaves of the corn. In more recent trials, CMU and endothal plus, 2,4-D have shown promise but no superiority to the TCA-2,4-D combination. SES has given less weed control. (Contribution from the Department of Agronomy and Plant Genetics, University of Minnesota; St. Paul, Minn. Paper No. 3072 Sci. Jour. Series, Minn. Agric. Exp. Station.)

Control of weeds in corn with dinitro-o-sec-butyl phenol as a post emergence spray. Sand, P. F. A variety of hybrid corn Wf9 x 38-11 N_1 x N_6 was planted May 22, 1953, on Waukesha silty clay loam, with a lister in 38 in. rows. Five replications of plots four rows wide and sixty ft. long were treated with 1,2,3,4, and 6 lb/A at four stages of growth, emergence, three leaf, six leaf, and nine leaf stage. Treatments were applied with a jeep sprayer on the first three stages and with a tractor mounted sprayer on the nine leaf stage. Drops were put on the boom for application of the chemical below the top of the plants for the 6 and 9 leaf stages. The emergence and three leaf stages were treated before cultivation and spray applied over the top of the corn. The temperature at the time of these two treatments was 80° and 75° F. respectively. The soil was dry at the time of all treatments. The six leaf stage received two cultivations before treatment and the nine leaf stage three cultivations. The temperature at the time of treatment was 90° and 85° F. respectively for these two stages.

Notes on degree of burning of the corn and on weed control were taken six to ten days after treatment. Application of 1,2,3,4, and 6 lb/A at emergence stage gave 14, 62, 72, 84, and 93 per cent weed control; 1, 2, 3, 4, and 6 lb/A at the three leaf stages gave 5, 39, 77, 87, and 97 per cent weed control. The six and nine leaf stages had no small weeds at the time of treatment, but only large weeds that had escaped cultivation. These weeds were burned and stunted but not entirely killed by any treatment. Cultivation on the 3,4, and 6 lb rates of the emergence and three leaf stages was delayed for about three weeks after treatment.

The greatest amount of burning of the corn was from the 4 and six pound rates which appeared to damage the plants quite severely, however, recovery was good except in the six leaf stage some corn plants were killed by the heavier rates. The 1,2, and 3 lb rates gave slight to moderate burning except in the six leaf stage the three lb rate gave severe burning. The six leaf stage was damaged more by the treatment than the other stage because of the difficulty in spraying below the top of the corn. (Contribution of the Department of Agronomy, College of Agriculture, Lincoln, Nebraska.)

DN as a post-emergence spray for corn. Slife, F. W. and Smith, R. J. An amine salt of dinitro-ortho-sec-butyl-phenol was applied as a post-emergence spray to small corn. Rates of application used were 3,4, and 5 lb of acid per acre. All rates were applied in a total solution of 40 gal/A. Treatments were made at 4 stages of corn growth, (1) coleoptile, (2) 1 to 2 leaves, (3) 3 to 4 leaves, and (4) 5 to 6 leaves. The experiment was set up as a randomized block design with 4 replications. The 3 lb rate of DN caused no visible damage at any of the 4 dates of treatment. Four lb of DN caused no damage at the coleoptile stage, but produced slight leaf burning at the later treatment stages. Five lb of DN caused no damage at the coleoptile stage, but produced moderate to severe leaf burn at the later treatment stages. This burning began to disappear about 1 week after treatment and was not noticeable 2 weeks after treatment. The 5 lb

rate reduced plant height slightly at all treatment dates except the coleoptile stage. Although yields have not been analyzed it would appear that yields have not been reduced by any rate of DN at any treatment date. Weed control was excellent on germinating weeds at the 4 and 5 lb rates and probably good enough at the 3 lb rate. This treatment should be studied further because it may be possible to control grasss weeds in corn, which are becoming an increasingly difficult problem. (Contribution Ill. Agr. Expt. Sta.)

An evaluation of pre-emergence chemicals for corn. Slife, F. W., Smith, R. J. Applications of chemicals were made May 26, 2 days after corn planting. The soil was a brown clay loam with good tilth. Soil moisture was good enough to get rapid germination of corn and fair germination of weeds, Rainfall after treatment was limited to a small shower 2 days after application and another small shower 15 days after application. No rain of any consequence fell until 1 month after planting. Chemicals and rates used as well as weed control rating is given in the following table.

Chemical	Rate in lb acid per acre	Weed control 0=no control 10=complete control
DNBP	8	10
DNBP	10	10
DNBP	12	10
Sesin	4	7
Sesin	5	8
Sesin	6	9
NaPCP	20	9
NaPCP	25	10
NaPCP	30	10
2,4-D Ester	1	6
2,4-D Ester	2	8
2,4-D Ester	3	8
2,4,5-T Ester	1	7
2,4,5-T Ester	2	9
2,4,5-T Ester	3	9
Natria	4	0
Natria	5	1
Natria	6	3
SES	4	7
SES	5	8
SES	6	9
CMU	1	4
CMU	2	6
CMU	3	8

Under the limited rainfall conditions of this test DNBP and NaPCP gave excellent weed control. These 2 chemicals caused stem burning on the small weeds which in most cases was fatal. Under the limited rainfall the 2,4-D type materials and CMU gave poorer results. Although yields have not been analyzed, there seems to be no evidence of yield reduction from any treatment. (Contribution Agron. Dept. Ill. Agr. Expt. Sta.)

DNBP as a post-emergence spray for the control of annual weeds in corn. Staniforth, D. W. and Bakke, A. L. Four replications of plots two rows wide and forty feet long were sprayed with 0, 1, 2, 3, 4 and 6 lb./A of an amine salt of dinitro-ortho-sec-butyl phenol, applied in ten and forty gallons of water per acre, and applied at each of two dates; (1) corn 2-3 leaves, foxtail and velvet leaf 1-3 leaves, (2) corn 6-8 leaves, and weed seedlings 4-8 leaves. Temperatures were 70°-75°F. at both dates of treatment. Cultivation on all treated plots was delayed two weeks, untreated plots received timely and effective cultivation. Notes on injury to corn and weed control, were taken two, six and fifteen days after the treatments. Yields of corn and plant stands, and yields of weeds which survived cultivation were obtained.

Weed control was slightly more effective when spraying was done at the 6-8 leaf stage, when the plots were observed before cultivation. However yields of weeds at maturity showed no difference in the degree of weed control obtained between the two dates of treatment or between the two levels of water used. Butterprint was killed by all dosages of chemical, while 2 lb. or more was required to kill the foxtail grass. Weed control as measured by harvest of mature weeds showed no difference between the cultivated control plots and those plots receiving 2,3 or 4 lb/A. of DNBP followed by delayed but effective cultivation. Six lb. A of chemical reduced the weed infestation 50% below the level in the control plots.

Burning of corn leaves was evident shortly after spraying with the 4 and 6 lb./A rates, but no reduction in stand of plant height was noted. None of the treatments caused any reduction in yield of corn. (Contribution of Botany and Plant Pathology Department, Iowa Agricultural Experiment Station.)

SORGHUMS

Summary — W. C. Elder

Only two abstracts were submitted on sorghums. One of these was concerned with herbicides, applied in different rates and at different stages of growth of the crop. The other one was concerned with the response of sorghum varieties to herbicides.

Considerable damage was reported from use of 1 lb./A of 2,4-D and MCP. 1/2 lb./A or less damaged sorghums when applied in the advanced stage of growth (early head development). When treated at the 5 to 6 inch height little damage occurred up to 1/2 lb./A rate.

Both reports indicate no advantage in using MCP on sorghums. One test found no difference between amine and ester types of 2,4-D while the other found amine 2,4-D safer to use on sorghums.

Variety difference to herbicides did not occur in 1953 tests, but are reported in former research reports.

Abstracts of Results of Cooperators

Effect of 2,4-D, 2,4,5-T and MCP on sorghum varieties. Elder, W. C., Davies, Frank and Dreessen, Jack. Six varieties of combine sorghums and four forage type sorghums were used in the test. Rates and chemicals used: 0, 1/2 lb./A 2,4-D amine and 1 lb./A each of 2,4-D and 2,4,5-T ester and MCP. The chemicals were applied when the sorghums were 8 - 10 inches high. It was hot and dry at time of application but the sorghums were growing rapidly. Good growing conditions continued throughout the season and grain and forage yields were above average for most of the varieties. All chemicals caused typical brace root injury to the sorghum plants. However, grain or forage yields were not affected by any of the treatments. The 1 lb. rates of 2,4-D ester and MCP delayed maturity of some varieties. Similar tests in past years have always caused yield reduction in some varieties when the chemicals were used at the 1 lb./A rate. The previous tests indicate that 2,4-D ester and MCP are more injurious to sorghums than 2,4-D amine and 2,4,5-T ester. 1/2 lb./A of 2,4-D amime has never reduced yields of sorghums in the tests during the last six years. (Contribution of the Agronomy Department, Oklahoma Experiment Station, Stillwater, Oklahoma.)

The effect of 2,4-D and MCP on the yield of sorghum. Phillips, W. M. Sorghum was sprayed with 2,4-D in 1950, 1952 and 1953 at 0, 1/8, 1/4, 1/2, and 1 pound per acre in the ester and amine salt formulations. In addition, in 1952 and 1953 the ester and amine of MCP were applied at the same rates. Two grain varieties, Midland and Westland, were used in tests in 1950 and Midland was used in 1952 and 1953. One forage variety, Ellis, was treated in 1950 and 1952. Applications of all rates and chemicals were made at the 5 to 6 leaf stage, the 10 to 12 leaf stage, and during the pollinating period. The results of the 1950 experiment showed that there was no significant difference between the reaction of the two grain varieties. There were highly significant differences between rates of application and dates of application with a non-significant difference between chemicals in 1950. In 1952 there were highly significant differences between chemicals, rates of application, and dates of application. In both experiments applications at the earliest stage of growth caused less reduction in yield than did later treatments. Yield reductions were greatest when the sorghum was 10 to 14 inches tall and had 12 to 14 leaves. This period of plant growth coincides with early development of the head. The following table of averages summarizes part of the data obtained from the 1950 and 1952 experiments. Yield data are not available from the 1953 experiment.

The effect of 2,4-D on the yield in bushels per acre of weed free Midland milo, Hays, Kansas. Average of experiments conducted in 1950 and 1952.

		Stage of Growth When Treated			
Formulation	Rates lbs./Ac.	5-6 in. tall	12-14 in. tall	Pollinating	Average Bushels
Ester	1/4	53.4	48.6	47.7	49.8
	1/2	55.0	41.0	41.9	46.0
	1	47.8	33.5	44.3	46.9
Amine	1/4	49.8	54.9	48.2	51.0
	1/2	49.9	49.1	47.1	48.7
	1	47.1	38.7	43.6	42.5
No treatment					54.6

In addition to the danger of reducing crop yield, 2,4-D caused a number of other effects on the sorghum plant. The most noticeable was the abnormal development of the root system. This effect was particularly noticeable when the chemicals were applied during the early stages of development. In 1952 and 1953 there was evidence of an increased number of late tillers on plots receiving 1/2 and 1 pound of 2,4-D and MCP per acre. These rates also caused 4 to 7 days delay in maturity. MCP appears to be fully as damaging to the sorghum crops as 2,4-D and is somewhat less effective in controlling some of the weed species commonly encountered in sorghum production. In 1950 and 1952 it was observed that the forage variety, Ellis, was considerably more tolerant of 2,4-D than were the grain varieties tested.
(Contributed by Division of Weed Investigations, BPISAE, USDA, Hays, Kansas.)

SOYBEANS AND PEAS

Summary — F. W. Slife

Chemical weed control in soybeans and peas is progressing, but not so rapidly as in the crops that belong to the grass family. Results from pre-emergence trials are encouraging. Several abstracts deal with post-emergence sprays on these crops, which are new, particularly for soybeans.

Eight abstracts were submitted on a variety of pre-emergence chemicals with soybeans. The results of these trials varied greatly, but the main variation seems to be due to soil and climatic conditions. DNBP and CIPC gave good results in most experiments, but several other herbicides gave good results and are certainly worthy of further investigation. Three abstracts were submitted on post-emergence sprays on soybeans. DNBP, 2,4-D and herbicidal oils were used. These chemicals and others may eventually have a place as post-emergence herbicides for soybeans.

Abstracts submitted on peas dealt with both pre-emergence and post-emergence trials. The pre-emergence trials dealt with the use of CIPC on peas for the control of wild oats. CIPC harrowed into the soil at 3, 4, and 5 lb/A gave no pea damage and fairly good control of wild oats. Rates higher than 5 lb. gave severe pea damage in the tests. Post-emergence trials dealt with the use of TCA, MCP formulations, and 2,4-D formulation. One investigator reports that TCA at 3 to 4 lb/A applied to peas at 2 to 2 1/2 in. in height has not injured peas and has given satisfactory control of foxtails. These results are from plot work and field trials. In an extensive comparison of 2,4-D, MCP, and 4 chlorophenoxyacetic acid formulations MCP, amine seemed to be most satisfactory of the three chemicals and of the formulations tested. After several years of testing, it appears that MCP has a place as a post-emergence spray for peas. One investigator has submitted an extremely important abstract on the influence of spray volume on tolerance of canning peas to MCP. It indicates that greater spray volume causes less pea damage at the same rate of MCP. This should be investigated on other crops and with other chemicals.

Abstracts of Results of Cooperators

The relative toxicity of phenyldimethylurea and CMU when used pre-emergence. Fletchall, O. Hale and Klingman, Dayton L. In pre-emergence tests on soybeans and corn, the control of broad-leaved weeds by the two herbicides, phenyldimethylurea and CMU, was nearly equal, but a differential existed for control of weedy grasses. At 1 lb/A in soybeans CMU gave 100% control of grasses; phenyldimethylurea, 90%. When each of these chemicals was applied in corn, at rates of 3/4 and 1 1/2 lb/A, pre-emergence, the control of the weedy grasses by CMU at the two rates, respectively, was 78 and 99%. Control by phenyldimethylurea was 44 and 64%. The weedy grasses consisted mostly of crabgrasses and foxtails. (Contribution of the Mo. Agr. Expt. Sta. and the Division of Weed Investigations, BPIS&AE, U. S. D. A. cooperating.)

Influence of spray volume on tolerance of canning peas to MCP. Buchholtz, K. P. Alaska peas were sown on May 6 along with a moderate stand of turnips to insure a weed growth. Plots 2 1/2 by 12 ft. in size were treated with an amine preparation of MCP on June 2 when the peas were about 6 in. tall. Spray volumes of 40, 20, 10 and 5 gal/A were used to apply 0.125, 0.25 and 0.5 lb/A of the acid equivalent of MCP. The treated plots along with an untreated check were arranged in a randomized complete block design with 4 replications. At the canning stage the peas

were harvested, yields of shelled peas obtained and tenderometer readings recorded. The yield data are shown in the table.

Rate - lb/A	Spray volume - gal/A				
	Check	40	20	10	5
Check	1592	--	--	--	--
0.125	--	1956*	1986**	1717	921**
0.25	--	1593	1160**	778**	616**
0.5	--	940**	704**	669**	467**

*L.S.D. at the 5% level, 274. **L.S.D. at the 1% level, 368.

Use of the lower volumes of spray usually reduced pea yields substantially even though the rate of MCP application was held constant. The increased wetting of the leaves and increased absorption of the herbicide following use of the more concentrated sprays probably accounts for the greater toxicity of these treatments. Two of the treatments increased yields above that of check, probably as a result of the control of turnips obtained and the lack of injury to the peas. Maturity of the peas was delayed by all treatments but the 0.125 lb. rate with 40, 20 and 10 gal. of water and the 0.25 lb. rate with 40 gal. If the plots had been harvested at comparable maturities, yield differences would have been less. (Dept. Agron., Univ. of Wis., Madison, Wisconsin)

Comparison of post-emergent treatments of MCP amine, MCP sodium salt, and 2,4-D amine for control of weeds in canning peas. Andersen, E. T. and Smits, O. Two varieties of peas, Pacemaker and Early Perfection, were sprayed with 2 1/2, 5, and 7 1/2 oz. (acid equivalent) of each chemical in fifty gallons of water per acre when the peas were about 5 inches high. The predominant weeds at the time of application were: red-root pigweed (Amaranthus retroflexus), prostrate pigweed (Amaranthus blitoides), purslane (Portulaca oleracea), stinkweed (Thlaspi arvense), wild buckwheat (Polygonum convolvulus), lamb's quarters (Chenopodium album), and barnyard grass (Echinochloa crusgalli).

Good control of stinkweed, amaranthus, and purslane was obtained with all rates and all chemicals. Wild buckwheat was controlled to some extent by the highest rate of MCP amine and 2,4-D amine only. Lamb's quarters were not controlled by any of the chemicals at any of the rates used. The highest rate of both formulations of MCP caused considerable twisting of the pea plants and some retardation of maturity; however, yields were not significantly reduced by either formulation. 2,4-D amine caused reduction in pea yields of 32, 20 and 8 per cent of yield of checks at the applied rates of 7 1/2, 5 and 2 1/2 oz. of 2,4-D respectively. (Contribution of the Division of Plant Science, The University of Manitoba, Winnipeg, Man.)

Pre-emergence herbicides on soybeans. Ilnicki, R. D., Ham, G. F., and Willard, C. J. Monroe soybeans were drilled solid in 25 ft. plots, triplicated, and a mixture of rape (1 part) and German millet (2 parts) sown broadcast from the grass-seed attachment of the drill at the same time on June 9 on Hoytville clay at Northwest Substation of Ohio Agricultural Experiment Station (Ilnicki). Herbicides were applied on three dates, June 11, 12 and 15. The following were applied on June 11: CIPC at 2, 4, 6, 8, and 10 lb/A; isopropyl N-(3-methylphenyl) carbamate (T-516) and isopropyl N-(2-methoxy-5-chlorophenyl) carbamate (T-518) at 8 lb/A; sec. butyl (N-(3-chlorophenyl)-carbamate (T-517) at 4, 8, and 16 lb/A; alkanol amine salt and isopropyl ester of 2,4-D, the alkanolamine salt and the polypropylene glycol butyl ether ester of MCP, all at 1 and 2 lb/A; Alanap 3 at 2, 4, and

8 lb/A; Endothal 3003 at 4 and 8 lb/A; and 4, 6, dinitro ortho sec. butyl phenol at 5, 7 1/2, 10 and 15 lb/A. Chemicals applied on June 12: CMU, PDU, and Sesin at 1, 2, and 4 lb/A; Alanap 1 at 2, 4, and 8 lb/A; Natrin at 4 lb/A; Na PCP at 8, 12, and 16 lb/A. On June 15 (one day prior to emergence) alkanolamine salt of DNBP was applied at 5 and 7 1/2 lb/A.

The outstanding materials and rates used were Alanap 1 and 3 at 4 lb/A, Premerge applied after planting at 7 1/2, 10 and 15 lb/A, Premerge applied prior to emergence at 7 1/2 lb/A, and CMU at 2 lb/A. Of these only CMU reduced stand about 15% and stunted beans; however, this effect was later outgrown. Essentially the Alanaps gave the same degree of control.

The Alanaps at 8 lb/A reduced stand approximately 15% and stunted beans, but the effect was not long-lived. The delayed application of Premerge produced greater control than that made immediately after planting. Premerge at 5 lb. applied after planting gave 53% control of grass and 57% control of broadleaves as contrasted with 68% and 83% control of these weeds when Premerge was applied just prior to emergence. With the 7 1/2 lb. rate 82% and 93% control was obtained as contrasted with 93% and 96% control at the later date. Almost complete control of weeds was obtained with Alanap 1 and 3 at the 4 lb. rate. The highest rate resulted in about the same degree of control.

Of the carbamates CIPC was the most outstanding. At the 8 lb. rate approximately 85% control of grass and 80% control of broadleaves was obtained. At the 10 lb. rate approximately 95% control of both types of weeds resulted. T-517 at the 16 lb. rate gave 75% and 70% control of grass and broadleaf weeds, respectively. T-516 and T-518 at 8 lb. were ineffective.

Both formulations of 2,4-D gave satisfactory control of weeds but also severely injured the beans. The amine, although more severe on the beans, resulted in slightly better weed control. This proved true with the MCP formulations as well. There was no great difference between the amine formulations of MCP and 2,4-D; however, the MCP ester was more toxic to beans and gave slightly better weed control.

Endothal at the 4 and 8 lb. rate was fairly effective on grass,resulting in 87% and 96% control for the two rates, respectively. Neither rate was effective on the broadleaves. Na PCP was ineffective at all rates. This was also true of Natrin. The latter reduced stand 5% and stunted beans somewhat. Sesin at 4 lb. gave 83% and 93% control of grass and broadleaves, respectively. The lower rates were ineffective.

Of the urea derivatives, CMU was superior. PDU at all rates was more toxic to the beans than the corresponding rate of CMU. At the 4 lb. rate CMU reduced the stand 77% and PDU 83%. CMU gave almost complete control of all weeds at this rate. PDU was slightly inferior. Marginal leaf chlorosis and firing appeared on PDU plots at all rates on June 22. A similar effect appeared on the CMU plots, 4 lb. rate only, on June 25. This did not last long. The leaves differentiated later did not have this firing; however, early in August it again became pronounced on the PDU 4 lb. rate plots. Yields will be determined later. It appears that there will be no significant reduction in yield, except on those plots in which the stand was greatly reduced. Entirely similar results were obtained at Columbus (Ham). (Contribution of Ohio Agricultural Experiment Station.)

Post-emergence application of DNBP on soybeans. Lee, Oliver C, and Clary, Gerald. Soybeans (Hawkeye) were treated with 2, 4 and 6 lb/A rates of DNBP in 80 gal/A of water when they had reached the primary leaf stage. Temperature was 80° at time of treatment. Plots were 9.33' x 15'. A randomized block design with five replications was used. Plots were cultivated 30 days after treatment. Estimated percent weed control and yield in bu/A are given below.

Treatment	Yield, bu/A	% weed control
2 lb/A	38.6	20
4 lb/A	35.6	60
6 lb/A	35.5	85
0 lb/A	38.1	--

The differences in yield for the 4 treatments were not significant. In most instances the primary leaves and cotyledons were burned severely by the treatment, but there was no effect on the leaves that developed after the plants were treated. (Department of Botany and Plant Pathology, Purdue University, Lafayette, Indiana.)

Response of soybeans and weeds to DNBP applied as a pre-emergence treatment on muck soil. Lee, Oliver C. DNBP was applied at rates of 8, 10 and 12 lb/A. The experimental design was a randomized complete block, 4 replications. Plots were 13' wide and 200' long; this width contained four 40" rows. Treatments were made 3 days after planting. Sufficient precipitation occurred prior to and following the treatment to cause rapid germination of soybeans and weed seeds.

All broad-leafed weeds, pigweed (Amaranthus retroflexus), smartweed (Polygonum persicaria),and ragweed (Ambrosia artemisiifolia) were controlled with all rates for a period of 20 days. Crabgrass (Digitaria ischaemum) was controlled only by the 10 and 12 lb/A rates. The DNBP at all rates was effective only for a period of approximately 20 days. Weeds emerging after that period survived. Although the number of weeds was reduced by the treatments, all plots were infested with considerable crabgrass, pigweed,and smartweed at the time of harvest. All treatments caused slight burning of the edges of the leaves of the soybeans in the early stage of growth. Plants were stunted for a period but recovered. No significant reduction in stand resulted from treatments. Yield determinations were not made. (Department of Botany and Plant Pathology, Purdue University, Lafayette, Indiana.)

DNBP, CMU, CIPC, phenyl dimethylurea, N-1 naphthyl phthalamaic acid and sodium pentachlorophenate as pre-emergence treatments on soybeans. Lee, Oliver C. and Clary, Gerald. Three rates of these materials were used. The soybeans (Hawkeye) were planted on May 29, and treatments were applied 24 hours later. An incomplete block design with 5 replications was employed. Plots were 9.33' x 16'. Soybeans were planted in 28" rows. Soil type is Crosby silt loam. Rainfall was normal during June and July, followed by a dry August and September. The area was cultivated some 30 days after treatment was applied. The table on the following page gives yields in bu/A.,stand count in number per yard row of soybeans, and estimated percent weed control for respective treatments.

Treatment	Lb./A	Soybean Stand	Soybean bu./A	% weed control 1/
DNBP				
	7	18.9	35.29	77
	8	19.1	36.73	72
	12	16.3	33.56	78
CMU				
	1.5	23.2	35.91	24
	2.0	22.4	36.94	61
	3.0	22.5	34.24	80
CIPC				
	8	21.1	36.59	84
	12	20.5	36.60	78
	16	22.2	31.89	92
Control		21.2	36.77	
N-1 naphthyl phthalamaic acid				
	5	22.3	36.92	16
	10	19.3	36.88	54
	15	22.8	36.90	56
Phenyl dimethylurea				
	1.5	21.0	37.33	0
	2.0	22.1	37.63	64
	3.0	20.0	38.33	90
Sodium pentachlorophenate				
	10	21.2	35.26	0
	20	21.5	35.78	42
	30	21.0	34.41	56
LSD at 5% - 2.73 bu./A				

1/ Weeds included smartweed (Polygonum persicaria), ragweed (Ambrosia artemisiifolia), butter print (Abutilon theophrasti), crabgrass (Digitaria ischaemum) and sedge (Carex spp.). DNBP 12 lb/A and CIPC 16 lb/A caused a significant reduction in yield of soybeans. All rates of DNBP caused temporary stunting of plants. Plants were dwarfed by the 16 lb/A rate of CIPC. All rates of DNBP, CIPC and heaviest rates of CMU and phenyl dimethylurea gave good weed control. (Department of Botany and Plant Pathology, Purdue University, Lafayette, Indiana.)

A comparative test of MCP formulations and low volatile esters of 2,4-D against other systemic herbicides on field peas. Pavlychenko, T. K., Bestrop, A.J. Plots of "Early and Best" field peas (Pisum spp.) were treated when 3 inches high with 2, 3 and 4 oz/A rates of butoxy ethanol ester of 2,4-D (Weedone LV4), ester of MCP (ACP 904), amine salts of MCP (Weedar MCP and Weedar MCP 60), and sodium salt of MCP (Methoxone), to compare with equal rates of ethyl ester of 2,4-D (Weedone Concentrate), amine salt of 2,4-D (Weedar 80), acid of 2,4-D (ACP 638), and ester (ACP 903) and amine salt (ACP 423) of para. The crop on clay loam soil was heavily infested with stinkweed (Thlaspe arvense), Russian thistle (Salsola kali) and Russian pigweed (Axyris amaranthoides).

Results: The results from this test showed rather consistently that amine salts of MCP (Weedar MCP and Weedar MCP 60) were both reasonably safe to the crop, up to 4 oz/A rates (4.5 and 5.2 bu/A increase in yield), and were quite effective in controlling weeds. Ester of MCP gave erratic results. The sodium salt of MCP was too tolerant to weeds, and yield was only slightly better than in checks (1 to 2.5 bu/A increase). Butoxy ethanol ester of 2,4-D was also quite tolerant to peas, while ethyl ester was too severe even at the 2 oz/A rate. Amine of 2,4-D gave good results at 2 oz/A rate, but reduced yield at 4 oz/A rate. The formulations of para (ester and amine) in many cases caused serious decrease (6.1 bu/A, ester) or gave slight increase in yield (2.1 bu/A, amine, 2 oz/A rate). (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

A comparative test of MCP formulations and butoxy ester of 2,4-D against other systemic herbicides on field peas. Pavlychenko, T. K., Bestrop, A. J. Plots of "Early and Best" field peas (Pisum spp.) when six inches high were treated with 2, 3 and 4 oz/A rates of butoxy ethanol ester of 2,4-D (Weedone LV4), ester of MCP (ACP 904), amine salts of MCP (Weedar MCP and Weedar MCP 60), sodium salt of MCP

(Methoxone), ethyl ester of 2,4-D (Weedone Concentrate), amine salt of 2,4-D (Weedar 80), emulsifiable acid of 2,4-D (ACP 638), and ester (ACP 903), and amine salt (ACP 423) of para. The crop on clay loam soil was heavily infested with stinkweed (Thlaspe arvense), Russian thistle (Salsola kali) and Russian pigweed (Axyris amaranthoides). Midsummer moisture was abnormally low.

Results: In this test where peas were treated at a more advanced stage, all chemicals produced a more lasting injury to the crop, as expressed by more pronounced injury to foliage and stems, slower recovery and subsequent delay in maturity (up to 2 weeks). A delay of over 5 days in maturity was always associated with either decreases or low increases in yield over the checks. Treatments with only slight delay in maturity consistently gave increases in crop yield. Of the 30 serial treatments used, 15 gave from slight (0.1 bu/A) to serious (5.4 bu/A) decrease, 2 were about equal to checks and 13 produced increased yield from 1.6 to 8.2 bu/A. Straight acid of 2,4-D (ACP 638) was the most injurious to peas, followed by ester and amine of para, Weedar 80, and Weedone Concentrate. The butoxy ethanol ester and formulations of MCP were more tolerant even at this stage. (Contributed by Agr. Div.,American Chemical Paint Company, Saskatoon, Sask.)

Effect of 2,4-D as a post-emergence spray on soybeans. Slife, F. W., Smith, R. J. In 1952 and 1953,2,4-D amine was applied as a post-emergence spray to Hawkeye soybeans. The experimental design was a randomized block with 4 replications. The soybeans were planted in rows 40 in. wide and cultivated 3 times during the growing season. Treatments were made with an experimental sprayer mounted on bicycle wheels. One row a rod long from each replication for each treatment was harvested for yield. Treatments each year were made at 4 stages of soybean growth. These stages of growth were (1) 4-5 in. tall, (2) 8-10 in. tall, (3) 18-20 in. tall, and (4) 30-32 in. tall. Treatments at each stage of growth were 2,4-D amine at 1/16, 1/8, 1/4 and 1/2 lb. acid per acre.

None of these treatments at any stage of growth killed the soybeans. All treatments delayed maturity slightly. Yield reductions varied both with the date of treatment and with the rate of treatment. Yield reductions were most severe at the 1/2 lb. rate of the fourth treatment but were less severe at each earlier treatment date. Although yields have not been analyzed, it appears that 1/16 and 1/8 lb. applied at the first treatment date have not affected yields, but these rates have reduced yields slightly at the later treatment dates. Height of soybean plants was affected by these treatments. The 1/16 lb. rate caused no height reduction at the first treatment but reduced plant height slightly as treatment progressed. The 1/2 lb. rate reduced mature plant height by several in. in the first treatment and by 1 ft. in the last treatment.

This 2-year study indicates that 1/16 lb. of 2,4-D acid in the amine form, if applied to soybeans when they are 4-5 in. tall, will not affect yields. One-eighth lb. could be used with little effect on yield. These rates of application, although light, are sufficient to kill giant ragweed (Ambrosia trifida), cocklebur (Xanthium spp.), and pigweed (Amaranthus retroflexus) if these weeds are in the seedling stage of growth. Although these rates could be used on soybeans at a more advanced stage with no serious effect on yield, they would not control the above weeds if they were more than 6-8 in. tall. This treatment has possibilities in bottomland areas where the above weed species are particularly prevalent. (Agron. Dept., Ill. Agr. Exp. Sta.)

Post-emergence oil on soybeans. Smith, Roy J., Slife, F. W. Soybeans (var. Hawkeye) were drilled in a clay loam soil on May 26, 1953. A randomized complete block-design with 4 replications was used. One-row plots (3.3 x 16.5 ft) were employed. Lion Herbicidal Oil No. 1 (LHO-1) was applied to the beans at 11 (first

trifoliate stage), 20 (fourth trifoliate stage), and 30 days (eighth trifoliate stage) after their emergence. A sprayer mounted on bicycle wheels was used. Drop nozzles were employed to obtain accuracy of placement. The LHO-1 was applied at 5, 7 1/2, and 10 gal/A. Each rate was applied onto the stem of the soybeans at the ground level, and between the primary leaves and the first trifoliate.

Results: The soybeans were completely recovered from the 11-day treatment 15 days after treatment. The injury prevailed longer for the 20-day and 30-day treatments than for the 11-day treatment; however, the 20-day treatment appeared to cause more damage than the other two. The high placement of spray caused more damage to the soybeans than the low placement for all rates, and as the rate increased more damage was produced. The types of injury were burning and killing of leaves, petiole and stem burning, killing of plants and lodging. Yield data indicated that for all dates, rates and placement of spray there were no marked differences. Weed control was not studied; however, this oil has controlled weeds satisfactorily in cotton. In order to obtain weed control, the spray would need to be directed at ground level. The data indicate that rates between 5 and 7 1/2 gal/A would give less apparent injury to the beans. The treatment should be made early (7-15 days after emergence), as less injury is exhibited by early treatment, the recovery is more rapid, and weeds are more susceptible to oiling when young. (Ill. Agr. Expt. Sta., Urbana, Ill.)

Yield of soybeans as influenced by stand. Smith, Roy J., Slife, F. W. Many times when herbicides are applied to soybeans a reduction in stand results because the herbicides are toxic to the beans due to certain unfavorable conditions that follow treatment. The purpose of this experiment was to study the effect of stand reduction on yield. Soybeans (var. Hawkeye) were drilled in a clay loam soil on June 4, 1953. A randomized complete block design with 4 replications was employed. The beans had emerged by June 7 and they were thinned on June 15, as shown in the table. Two-row plots (6.6 x 20 ft.) were used. The following table shows the average yield for each treatment:

Treatment	Yield bu/A
Full stand (1 bu/A)	30.3
3/4 stand (by pulling out every fourth plant)	30.8
1/2 stand (by pulling out every second plant)	31.0
1/4 stand (by leaving every fourth plant)	25.2
6 in. gaps (taking out every other 6 in. - equivalent to 1/2 stand)	29.4
1 ft. gaps (taking out every other 1 ft. - equivalent to 1/2 stand)	29.3
3 ft. gaps (taking out every other 3 ft. + 1 ft. - equivalent to 1/2 stand)	24.1
5 ft. gaps (taking out every other 5 ft. - equivalent to 1/2 stand)	20.4

Results: When the stand of soybeans is reduced uniformly, e.g., 3/4 and 1/2 stands, the yield is not correspondingly reduced. This is due to the bean plants spreading out and filling in the space. However, when long gaps, e.g., 3 and 5 ft. gaps, are present, the yield is markedly decreased because the plants cannot fill in such long gaps. When the stand is reduced, as in the 1/2 and 1/4 stands, many branches run along the ground. Although we harvested these low branches since we were using hand-harvesting equipment, many of them would not be harvested if machinery were used to harvest; however, the yield would not be decreased greatly. When chemical weed control herbicides are used, big reductions in stand may occur without corresponding reduction in yield; however, if long spaces are present, with no beans, a reduction in yield can be expected. (Ill. Agr. Expt. Sta., Urbana, Ill.)

Pre-emergence herbicides in soybeans. Smith, Roy J., Slife, F. W. Soybeans (var. Hawkeye) were drilled in a clay loam soil on May 12 and on May 26, 1953. A randomized complete block with 4 replications was the design for both experiments. Yield of both experiments was taken by harvesting 2 rods from each plot. Chemicals were applied at specific rates in 29 gal. of water/A by employing a sprayer mounted on bicycle wheels.

Early-planted experiment: Plots were 6.6 x 29 ft. Pre-emergence treatments were made May 15 (3 days after planting). Chemicals and rates: DNBP (alkanol amine salts) at 4.0, 5.5 and 7.0 lb/A; CIPC at 4.0, 5.5 and 7.0 lb/A; sodium PCP at 7.5, 10.0 and 12.4 lb/A phenol equivalent; 2,4-D amine salt at 1, 1.3 and 1.7 lb/A; sodium salt of N-1 naphthyl phthalamic acid (sodium N-1) at 2.7, 4 and 5.4 lb/A. On May 16 (4 days after planting) a very slow rain of considerable amount fell.

Results: Date of emergence observations indicated that beans treated with sodium N-1 emerged 1 day later and beans treated with 2,4-D amine emerged 3-4 days later than the soybeans with other treatments. Injury ratings on the soybeans indicated that the sodium N-1 was slightly toxic, 2,4-D was considerably toxic, while the other treatments were approximately equal to the control. Weed control ratings indicated that DNBP, CIPC and sodium PCP controlled weeds well (70% or better) with all rates, and especially well (80% or better) with the high rate of each chemical. 2,4-D amine salt at all rates and sodium N-1 at 2.7 lb/A did not control weeds very well. Principal weed species present were smartweed (Polygonum spp.), crabgrass (Digitaria spp.), pigweed (Amaranthus retroflexus) and wild buckwheat (Polygonus convolvulus). Yield data showed no marked differences among treatments or between treatments and control.

Late-planted experiment: Plots were 6.6 x 29 ft. with border rows. Pre-emergence applications were made on May 28 (2 days after planting). Chemicals and rates: DNBP (alkanol amine salts) at 6, 8 and 10 lb/A; CIPC at 6, 8 and 10 lb/A; sodium PCP at 11.2, 15 and 18.8 lb/A; 2,4-D amine salt at 1 1/2, 2 and 2 1/2 lb/A; sodium N-1 at 4.6 and 8 lb/A. No rain occurred until after the soybeans had emerged. A small blowing shower fell on June 5 (10 days after planting). The beans at this time were in the primary leaf stage. DNBP, at all rates, caused considerable burning (36-48 hr. after the rain) on the leaves and stems of the soybeans, and at 10 lb/A the stand was reduced to some extent, but not severely. Sodium PCP, at the 11.2 and 15 lb/A rates, produced slight burning of the soybean leaves and the 18.8 lb/A rate caused considerable burning; however, it was not so severe as that produced by DNBP. The recovery of the soybeans from this burning was rapid. The other chemicals showed no injury to the soybeans.

Yield data did not reflect the influence of the early injury by exhibiting no marked differences between treatments. Because the surface soil was very dry, no weeds germinated. A well-established belief is that the effectiveness of pre-emergence treatments on soybeans as well as on other crops is influenced markedly by the weather conditions which follow applications of the herbicide. Apparently the weather conditions that followed the earlier planted experiment were ideal for pre-emergence treatments, while those which followed the later planted experiment were not as favorable. This is reflected in the fact that weed control was obtained in the early-planted experiment, probably because the chemicals were leached into the surface inches of the top soil by the rain and there was enough moisture for germination of seed, while there was no weed control in the later one because no moisture was present in the surface to cause germination of weed seed.

Under favorable conditions for pre-emergence, DNBP, CIPC, and sodium PCP appear good, while 2,4-D amine and sodium N-1 appear not so good. When conditions occur such as prevailed under the later planted experiment, chemical weed control is not necessary; however, under these conditions, there may be injury to the soybeans when DNBP and sodium PCP applications are made if a light, blowing rain occurs just after the soybeans have emerged. CIPC appeared good under favorable conditions in the sense that weed control was good and there was no injury to crops, while it was not toxic to soybeans under the conditions of the later planted experiment. (Ill. Agr. Expt. Sta. Urbana, Ill.)

Pre-emergence and post-emergence application of herbicides for weed control in soybean. Staniforth, D. W., Bakke, A. L. and Isleib, D. R. Pre-emergence herbicide treatments were applied to plots of Hawkeye soybeans at each of two dates, immediately after planting and one day before bean emergence. SES and three of its derivatives were also applied as post-emergence herbicides one week after bean emergence. Rainfall during the month following seeding was limited to one inch, occurring one day after bean emergence. Soil type in the experimental area was Webster silty-clay loam. The untreated check plots were cultivated June 3, three weeks after seeding. All plots were cultivated June 10, and at three dates during the season. Herbicide treatments were evaluated on the basis of suppression of weed growth, the extent of weed infestation present at crop maturity and the effect of the herbicide on the soybean growth and yield. Weed infestation consisted of yellow and green foxtail, Pennsylvania smartweed and red root pigweed.

Butyl ester of 2,4-D gave good weed control and significant yield reductions at 1 and 2 lb/A. Dow Premerge was effective at 8 and 12 lb/A and caused no reduction in bean yield. Sesin, SES and Natrin were not effective at rates of 1, 2 and 4 lb/A. Alnap 1 and Alnap 3 gave good weed control at 8 and 12 lb/A but caused moderate reductions in bean yield. CIPC did not give adequate weed control at rates below 8 lb/A. CMPC was not as effective as CIPC in these tests. Other carbamate derivatives tested included the isopropyl N-3 methylphyl, isopropyl N-(methoxy-5 chlorophenyl), methyl N-(2 methyl-5 chlorophenyl) and sec-butyl N-(3 chlorophenyl) carbamates. Of these the sec-butyl N-(3 chlorophenyl) carbamate appeared very promising at rates of 4 and 8 lb/A applied immediately after soybean planting. This herbicide was the only one in the test which gave increased weed control and caused no reduction in bean yield, compared with the cultivated check plots. (Department of Botany and Plant Pathology, Iowa Agricultural Experiment Station. Ames, Iowa.)

The effect of 9 herbicides applied pre-emergence (immediately after planting) to soybean (Lincoln) seed treated with charcoal. Tafuro, A. J., Beatty, R. H., Jack, C. C. A pre-emergence spray to soybeans (Lincoln variety) replicated three times, plot size 4 1/2' x 20'. Each plot was divided into two parts; one half contained 50 seeds coated with charcoal and the other half contained 50 seeds untreated. All plots were planted by hand. Materials used were Cl IPC at 4 and 8 lb/A, water-soluble DN at 5 and 10 lb/A, MCP at 1 and 1 1/2 lb/A, sodium PCP at 8 and 16 lb/A, phthalamic acid at 3 and 6 lb/A, the amine of 4-chloro at 1 1/2 and 3 lb/A, butoxy ethanol ester of 4-chloro at 1 1/2 and 3 lb/A, emulsifiable PCP at 8 and 16 lb/A, and a 2,4-D ester (W LV-4) at 1 and 1 1/2 lb/A. All materials were applied with a hand sprayer at the rate of 30 gal. of water/A.

Delayed germination and stunting of the young soybean plants was observed in all charcoal treated plots including the check plot. Epinasty and stunting of the soybean plant was observed in the MCP, both forms of 4-chloro and W LV-4 plots at both rates used. The DN at the 10 lb. rate stunted soybean plants. All these

materials gave satisfactory weed control to annual grasses and broadleaf weeds. Cl IPC, sodium PCP, phthalamic acid, and emulsifiable PCP, at both rates, did not cause injury to soybean plants. Cl IPC at 4 lb. did not give satisfactory control; the 8 lb/A rate controlled annual grasses (crabgrass) and at least 60% of the broadleaf weeds (pigweed and lambs-quarters). DN at 5 lb/A controlled 70% grasses and broadleaf weeds, both PCP formulations, the phthalamic acid controlled only about 50% of the grasses or broadleaf weeds. Two weeks before spraying, rainfall was 1.33 in.; and 3 weeks after spraying, rainfall was 3.88 in.

Percent Stand of 50 Seeds Treated and 50 Seeds Untreated

		Charcoal-treated seed	Untreated seed			Charcoal-treated seed	Untr. seed
Cl IPC	4 lb/A	80	90	4 Cl (Amine)	1 1/2 lb/A	86	88
	8 lb/A	86	86		3 lb/A	76	70
MCP	1 lb/A	78	80	4 Cl (ester)	1 1/2 lb/A	78	90
	1 1/2 lb/A	82	86		3 lb/A	76	76
Na PCP	8 lb/A	84	86	PCP (E)	8 lb/A	84	88
	16 lb/A	84	88		16 lb/A	80	84
Check	no chem.	80	90	DN(Sinex PE)	5 lb/A	74	84
PA	3 lb/A	76	86		10 lb/A	66	74
	6 lb/A	80	86	W LV-4	1 lb/A	72	79
					1 1/2 lb/A	66	76

(Contributed by Agr. Div., American Chemical Paint Company, Ambler)

The pre-emergence application of CIPC to control wild oats in land seeded to field peas. Wood, H. E., Craig, H. A., Tooth, A., Vodrey, F. C., McKenzie, J. D. Extensive trials planned early in 1953 in which isopropyl-N-(3-chloropheny) carbamate (CIPC) would be tested for the control of wild oats in field peas was made difficult to conduct and the results conflicting and inconclusive by an extremely wet spring. At 4 locations near Portage la Prairie on heavy loam soils, plots were pre-emergent knapsack, and machine boom-sprayed, using from 3 to 12 lb. active ingredient. At all locations application followed planting of the peas by 2 to 4 days. Harrows were used to incorporate the chemical. With the knapsack 80 and 160 imperial gal. water/A were used; 10 gal. for machine spraying.

While wild oat control varied greatly, results were in the main promising. Damage to peas was considerable where over 5 lb. CIPC was applied; very little at the 3 to 4 lb. rate. (Contribution from the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada).

Controlling green foxtail in field peas with TCA. Wood, H. E., Tooth, A., Heale, G. Near Portage la Prairie field peas heavily infested with green foxtail (Setaria viridis), were post-emergence sprayed with sodium TCA. At two locations square rod plots were knapsack-sprayed, using 2 1/4, 4 1/2 and 9 lb. and 2 1/2, 5 and 10 lb. respectively TCA acid equivalent, in 80 imperial gal. water/A; peas were 2 to 3" high, foxtail emerging to 1 1/2" high; weather warm, cloudy; moisture ample. 100% foxtail control was obtained at the higher rates; fairly good control at even the lowest rates. There was no apparent damage to peas at the lower rates, but noticeable retardation and stunting at the 9 and 10 lb. rates.

Two quite extensive fields were machine sprayed with both the peas and foxtail considerably more advanced than was the case on the plots, using approximately 3 to 4 lb. TCA acid equivalent in 5 gal. water/A. Results in both fields were comparable with the plots - no damage to peas, satisfactory control of foxtail. In one field control was less satisfactory than in the other--accounted for by delayed application and lower dosage (about 3.2 lb.).

Under Manitoba conditions field peas appear safe to treat with TCA provided the dosage does not exceed 4 lb/A and treatment is made when the foxtail is not over 2 to 2 1/2" in height. (Contribution from the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada.)

LEGUMINOUS FORAGE

Summary

John H. Miller

Nineteen abstracts from eleven sources were received. Of these, eleven dealt with seedling legumes and eight with established legumes. As in past years, alfalfa was studied more widely than any other legume. Seventeen abstracts dealt with alfalfa, ten with sweet clover, seven with red clover, three with Ladino clover, two with alsike clover, and one each with birdsfoot trefoil and lespedeza. The herbicides used included several formulations of 2,4-D, MCP, and 4 chloro, 2,4,5-T, TCA, IPC, CIPC, DNBP, endothal, CMU, Dalapon, MH, KCNO, and beta napthoxyacetic acid. Of the eight abstracts that dealt with established legumes, six dealt with alfalfa, one with sweet clover, and one with five species of legumes. Coupland, using several herbicides, found alfalfa to be quite tolerant of these when the alfalfa was less than 1 in. high and that tolerance decreased as the plants developed, but generally found alfalfa to be injured by rates that controlled weeds. He also found that 2-year-old stands of alfalfa were more tolerant to herbicides than 1-year-old stands. Miller, working with five species of legumes at the 3-4 in stage, found all legumes to be injured by 1/2 lb rates of 2,4-D amine and all except Ladino by 1/4 lb rates. He found red clover to be more tolerant to MCP than to 2,4-D but little difference between them for other legumes. He also reported TCA at 10 lb did not injure alfalfa or sweet clover but severely injured Ladino, alsike, and red clovers.

Reports on two herbicides were of particular interest; one in which MH was used at the rate of 2 lb/A without injury to alfalfa with elimination of white cockle and curled dock; the other (two reports) where Dalapon was applied to alfalfa. Davidson reported that 9 lb of Dalapon eliminated downy brome grass without permanent injury to alfalfa and Burt, using much higher rates of application, applied 20 and 40 lb/A with only slight injury to alfalfa.

Two workers, while one applied herbicides to alfalfa and the other studied drift of 2,4-D upon sweet clover, reported that herbicides had a marked influence upon the floral development of alfalfa and sweet clover. Bolton reported 4 chloro to have particular detrimental effects upon alfalfa and Greenshields showed sublethal drift dosages of 2,4-D to markedly decrease sweet clover seed yields.

Of the eleven abstracts dealing with seedling legumes, ten were concerned with alfalfa, eight with sweet clover, six with red clover, two with Ladino clover, and one each for alsike clover, birdsfoot trefoil and lespedeza. Two abstracts dealt with pre-planting herbicide applications and one with residue management practices.

Brown, Derscheid, Miller, and Olson were unable to show that 1/4 lb applications of 2,4-D amine or MCP amine were injurious to legumes (compared to weedy control control) except Miller indicated injury to sweet clover. Pavlychenko reported only slight injury with these rates at very early stages of growth but indicated more satisfactory results from using the "low volatile" esters at 1/8 and 1/4 lb/A. On the other hand, Dorschner and Forsberg found significant injury to alfalfa with the amines at these rates. The ester formulations, in general, were reported to be more injurious to legumes than salt formulations. A clearly defined difference between amine salts of 2,4-D and MCP could not be made as two workers indicated more damage from 2,4-D while two indicated

the contrary. Other workers did not offer a distinction between them. It was reported that selectivity between small alfalfa and small weeds was greater than between alfalfa 5-6 in high and correspondingly larger weeds.

Pavlychenko indicated only slight injury to legumes by 4 chloro, while Forsberg showed slightly more injury from it compared to amine salts of 2,4-D or MCP. TCA at 5 to 10 lb rates did not injure alfalfa although one worker reported poor grass control at these rates. Red and alsike clovers were severely injured by TCA at these rates. Two workers reported promising results from IPC and CIPC for grass control in alfalfa. Klingman, Miller, and Pavlychenko reported legumes to be injured by 1-3 lb rates of CMU, however, Miller reported only slight injury to alfalfa.

Dorschner was able to materially enhance survival of alfalfa treated with 2,4-D by clipping the companion crop residue. Removal of the clipped residue did not materially change alfalfa survival.

Effect of various herbicides on established stands of alfalfa, 1953. Coupland, R. T. and J. L. Bolton. Nine formulations of selective herbicides were applied in triplicate to a 2 year old stand of alfalfa at Saskatoon at three stages of development: 1. April 27, alfalfa less than 1 in high; 2. May 6, 2-3 in high; 3. May 19, 5 in high. Rates of treatment were 4, 8, 16 and 32 oz of acid in the first stage and 2, 4, 8 and 16 oz in the later two stages. No apparent damage resulted from treatment in the first stage. The herbicides caused damage in the second and third stages in the following order (most severe first): butoxy ethanol ester of 2,4,5-T, ethyl ester of 2,4-D, butoxy ethanol ester of MCP, butoxy ethanol ester of 2,4-D, butoxy ethanol ester of 4-chlorophenoxyacetic acid, alkanolamine of 2,4-D, alkanolamine of MCP, sodium salt of MCP, amine of 4-chlorophenoxyacetic acid.

Results: Damage was generally greater in the third stage than in the second stage. Only slight damage was caused by the 4 oz rates of esters and the 4 and 8 oz rates of amines. The amine of 4-chlorophenoxyacetic acid and the sodium salt of MCP caused only slight damage at 16 oz. Weed control was very satisfactory from 16-32 oz of 2,4-D esters and MCP ester, but other treatments resulted in only fair to moderate weed damage. (Contribution of the Dept. of Plant Ecology, University of Saskatchewan and the Forage Crops Laboratory, Canada Dept. of Agriculture, Saskatoon. Approved for publication.)

Effect of 2,4-D on alfalfa stands of two ages, 1953. Coupland, R. T. and J. L. Bolton. Alkanolamine and ethyl ester formulations of 2,4-D were applied to triplicated plots of 1-year-old and 2-year-old stands of alfalfa at Saskatoon. Treatment was made at three stages: 1. April 27 when growth was less than 1 in high; 2. May 9 when alfalfa was 3-5 in; 3. May 20 when alfalfa was 5 in high. The rates of treatment were 4, 8, 16 and 32 oz of acid/A in the first stage and 2, 4, 8 and 16 oz/A in the two later stages.

Results: In almost every instance, subsequent growth of the 1-year-old stand was stunted much more than by the corresponding treatment on the 2-year-old stand. Ester caused more damage than amine. No effect was apparent by mid-June from any rate in the first treatment on the 2-year- old stand. Damage was slight (dwarfing or leaf curl) in the 2-year-old stand from amine at 2-8 oz. and from ester at 2 oz in stages two and three. 16 oz of amine and 4 oz of ester produced moderate damage while 8-16 oz of ester produced severe damage in stages two and three. In the 1-year-old stand, no damage was observed from

4-8 oz of amine in the first stage and 2-4 oz of amine in the second stage. Slight damage occurred from 16-32 ox of amine and 4 oz of ester in the first stage and from 8-16 oz of amine in the second stage. Moderate damage resulted from 8-32 oz of ester in the first stage, 2 oz of ester in the second stage and 2-4 oz of amine in the third stage. Heavier treatments caused severe stunting and some mortality. This suggests that rates of 2,4-D sufficient to kill early germinating weeds (e.g. Russian pigweed) can be applied with safety to established stands of alfalfa in the early spring. (Contribution of the Dept. of Plant Ecology, Univ. of Sask., and the Forage Crops Laboratory, Canada Dept. of Agriculture, Saskatoon. Approved for publication.)

Effect of herbicides on floral development of alfalfa. Bolton, J. L. and R. T. Coupland. Nine formulations of selective herbicides were applied in triplicate to 2 yr old stands of alfalfa at Saskatoon at three stages of development: 1. April 27, alfalfa less than 1 in high; 2. May 6, 2-3 in high; 3. May 19, 5 in high. Rates of treatment were 4, 8, 16 and 32 oz of acid in the first stage and 2, 4, 8 and 16 oz in the later two stages. Floral development was delayed by most treatments.

Results: Floral abnormalities occurred abundantly in plots treated with the 4 rates of butoxy ethanol ester and the 8 and 16 oz rates of amine of 4-chlorophenoxyacetic acid in the second and third stages, but these were only occasional in other treatments. Malformation of the floral enfelope and drying up of buds were the abnormalities observed. These were occasional in plots treated with the higher rates of butoxy ethanol ester of MCP and 2,4-D and the ethyl ester of 2,4-D. No effect was noted from applications of amine of 2,4-D, sodium salt and amine of MCP, or ester of 2,4,5-T. These observations suggest the inadvisability of using 4-chlorophenoxyacetic acid for weed control in alfalfa seed fields. (Contribution of the Forage Crops Laboratory, Canada Dept. of Agriculture and the Dept. of Plant Ecology, Univ. of Sask., Saskatoon. Approved for publication.)

Effect of 2,4-D and MCP on alfalfa and sweet clover seedlings, 1953. Brown, D. A. Grimm strain alfalfa and Arctic white sweet clover were seeded without a companion crop. Herbicides used were 2,4-D low volatile butyl ester; and ester, amine and sodium salt formulations of MCP each applied at 2, 4, and 6 oz acid equivalent/A. Single treatments were given at four stages of growth, i.e. when plants were 2, 4, 7, and 9 in. in height.

Results, Alfalfa: At the 2-in or 5-leaf stage, seedlings sustained a set-back but within six weeks plants had regained normal growth except on plots treated with 2,4-D and MCP ester at the 6 oz rate. Even at the high rate, however, there was a 78% recovery before the end of the growing season. Crop 9 in high was killed 95% by the 4 and 6 oz rates of 2,4-D ester; 80% by MCP ester, and 50 and 40% respectively by amine and sodium salt.

Results, Sweet Clover: followed the same responsive trend as alfalfa, the main difference being that injury was more pronounced at the higher rates on the 2-in seedlings and less severe at the 9-in stage. Recovery compared favorably in both crops.

Weed Control: Best control occurred at the higher rates applied at the 6-9 in stage. There was convincing evidence that weed killing was more complete as injury to the crop became more pronounced.

Conclusions: There were indications in 1953 that amine and sodium salt formulations could safely be applied to alfalfa and sweet clover up to the 6 oz rate provided spraying was done when the seedlings are from 2-4 in high. (Contribution of the Experimental Farm, Brandon, Manitoba.)

Maleic hydrazide as a control measure for curled dock and white cockle in alfalfa. Buchholtz, K. P. An old alfalfa sod containing some Ladino clover and wild fescue (Festuca obtusa) and heavily infested with curled dock (Rumex crispus) and white cockle (Lycnis alba) was treated with maleic hydrazide (MH) at rates of 0, 1, 2, 4, and 8 lb/A on May 6 when the alfalfa was about 3 in tall. At that time the dock and cockle plants had started leaf growth but shoot elongation had not begun. Plots were 9 x 50 ft in size with four replications. The MH was supplied in water equivalent to 20 gal/A. The Plots were sampled at the hay stage on June 23. Yields of hay were obtained, percentages of weeds determined and weed counts made. The data are shown in the table.

Rate lbs/A	Weedy plants No/sq ft	Weeds in hay pct	Weed-free hay lbs/A
0	2.56	31.9	2425
1	.19	0.0	3376**
2	.00	0.0	3187**
4	.00	0.0	2447
8	.00	0.0	1749**
L.S.D. at the 5% level -		-	223
L.S.D. at the 1% level -		-	313

Results: Top growth of the dock and cockle was nearly eliminated by the 1 lb/A application. Yields of weed-free forage were materially increased over check by the 1 and 2 lb applications. Growth of the fescue and Ladino was noticeably less on plots receiving the 2 lb treatment and severely reduced at higher rates. Alfalfa growth was affected by the 4 and 8 lb applications. The dock and cockle plants were not killed outright by the MH applications, but failed to produce shoots or flowers. The severe competition offered by the alfalfa thinned the stand of these weeds and greatly weakened the plants remaining. (Dept. of Agron., Univ. of Wis., Madison, Wisconsin. Approved for publication.)

Dalapon for the control of downy brome grass (Bromus tectorum) in alfalfa (variety Grimm). Davidson, J. H. Applications of Dalapon as the sodium salt with wetting agent were made early in the spring of 1953 at rates of 3, 6, and 9 lb technical acid equivalent in 20 gal of water/A for the control of downy brome in alfalfa. These treatments were applied on March 20 and April 7. Alfalfa crowns were showing green but were protected by the tops of old plants at both times of spraying. Control of downy brome grass was good at the 3 lb/A rate and excellent at the 6 and 9 lb rate. A total of 0.25 in of rain fell in four different showers during the ten-day period following March 20. Rainfall during the 10 day period after the April 7 application totaled 0.77 inches in four showers.

Results: Kill of downy brome grass was not completely evident until five weeks after treatment. No injury was evident on the alfalfa from the 3 and 6 lb rates. Early growth on occasional alfalfa plants in the 9 lb rate showed slight chlorosis and formative effects on foliage but did not result in any permanent injury. The 6 and 9 lb/A rate suppressed the growth of quack grass until after the first cutting of alfalfa. (Contribution of The Dow Chemical Co., South Haven, Mich. Approved for publication.)

Effects of several chemicals on tonnage of sweet clover plowed under after treatment in seedling year. Derscheid, Lyle A. Two experiments were conducted: sweet clover underseeded in flax and sweet clover underseeded in oats. Treatments were applied to triplicate 5 x 15 ft plots when sweet clover was 6 in tall (flax starting to bud, oats starting to boot) in 1952 and yields were taken in 1953 to determine the amount of green manure available for plowing under. All treatments were applied at a 13 gal/A volume.

Experiment I. Sweet clover underseeded in flax was treated with 2,4,5-T amine 1/4 lb/A rate or 2,4-D amine, MCP amine (60% 2-methyl-4-chloro), MCP amine (85% 2-methyl-4-chloro) at 1/4 or 1/2 lb/A rates or TCA sodium salt at 5 or 10 lb/A, IPC or CIPC at 2, 4, or 8 lb/A rates, or endothal at 1, 2, or 4 lb/A or DNBP ammonium salt at 1/2 or 3/4 lb/A. Yield data were obtained on a 3 x 15 ft area and analyzed statistically. Yields varied from 1.6T/A to 2.3T/A but it was not established that there was any statistical difference among yields. The lowest yield was from plots treated with 1/2 lb/A 2,4-D amine. The yield of untreated plots and plots treated with 2,4-D, 1/4 lb/A; MCP (85%) 1/4 or 1/2 lb/A; MCP (60%) 1/2 lb/A, TCA 5 or 10 lb/A fell between 1.8 T/A and 2.0 T/A. Other yields were above 2 T/A except endothal 2 lb/A and IPC 4 lb/A which were 1.8 T/A. There is no apparent explanation for these two low yields as higher rates had higher yields.

Experiment II. Sweet clover underseeded in oats was treated with 2,4-D ethyl ester, 2,4-D butoxyethanol ester, 2,4-D amine, the two MCP amines, or 2,4,5-T amine at 1/4 or 1/2 lb/A rates or DNBP ammonium salt at 1/2 or 3/4 lb/A. Yields were obtained as in Experiment I. Sweet clover yields ranged from 1.9 T/A to 2.6 T/A but it could not be shown that any were significantly different from the untreated check. Yields from lots treated with 2,4-D ethyl ester 1/4 or 1/2 lb/A, 2,4-D butoxyethanol ester 1/4 or 1/2 lb/A, 2,4-D amine 1/2 lb /A, 2,4,5-T amine 1/4 or 1/2 lb/A fell between 1.9 and 2.1 T/A. All others were between 2.1 and 2.4 T/A except plots treated with 1/2 lb/A of MCP amine (85%) which produced 2.6 T/A.

These data do not agree with most data obtained on sweet clover but treatments were not applied until sweet clover was fairly large and crop had produced a rather dense canopy. These data indicate that there is little difference between flax and oats for companion crop and that toxicity to crop is as follows: DNBP < MCP < 2,4-D amine = 2,4,5-T amine < 2,4-D esters = TCA when using rates normally needed to control annual weeds. However, DNBP did not give satisfactory weed control. (Contributed by Agronomy Department, South Dakota Agricultural Experiment Station, College Station, South Dakota. Approved for publication.)

Grain stubble management as a factor affecting seedling alfalfa stands. Dorschner, K. P. and Buchholtz, K. P. In 1952 and 1953 plots of oats 6 x 12 ft in size seeded to Ranger alfalfa were sprayed with the amine salt of 2,4-D at 0.0, 0.25, 0.5, and 1.0 lb/A acid equivalent in water equal to 20 gal/A. four replications were used. Spraying was done when the oats were 12-18 in tall. After the grain was combined the remaining stubble was either raked only, clipped only, or clipped and raked. Two months after the post-harvest treatments tha alfalfa plants were counted in 3 two sq ft. quadrants on each plot. The table lists the results for 1952 and 1953.

2,4-D application lbs/A	Stubble management	Alfalfa plants/2 sq. ft. 1952	1953	Ave. 1952-53
0.0	Rake only	—	5.57	—
0.25	"	5.60	5.92	5.76
0.50	"	2.50	1.75	2.00
1.00	"	0.00	0.07	0.03
0.0	Clip only	—	16.67	—
0.25	"	12.90	10.42	11.66
0.50	"	4.50	5.32	4.91
1.00	"	0.07	0.00	0.03
0.00	Clip & rake	19.90	14.75	17.33
0.25	"	11.50	11.75	11.62
0.50	"	4.30	7.35	5.82
1.00	"	0.30	0.67	0.48
L.S.D. at the 5% level		6.3	3.8	—
L.S.D. at the 1% level		5.6	3.3	—

In both years the stand was enhanced by a clipping type of post-harvest management practice. This was of special importance on plots treated with 2,4-D for the average stands on plots receiving 0.25 lb/A of 2,4-D was increased from 5.76 plants to 11.66 and 11.62 plants/2 sq ft respectively by the clipping and clipping and raking. The average of the two years' data indicate that there is no particular value in raking after clipping. The value of post-harvest management in maintaining untreated alfalfa stands is shown by the 1953 plots which were not treated with 2,4-D. The increase in stand is presumed to be due to control of a heavy growth of annual grassy weeds which developed on all unclipped plots. Dept. of Agron., Univ. of Wis., Madison, Wisconsin. Approved for publication by Director.)

Effect of herbicides on legume seedlings. Forsberg, D. E. and Friesen, H. A. In a 6 replicated test, herbicides were applied to seedlings of Ladak alfalfa in the second true leaf stage. The MCP butyl ester, amine and sodium salt and a 2,4-D amine were sprayed at dosages of 1/8 and 1/4 lb of acid equivalent/A; the MCP amine was also sprayed at the 3/8 lb/A rate. Also included in this test was DNOSBP at dosages of 3 qt in each of 40 and 80 gal of water/A and 4-chlorophenoxyacetic acid (4-chloro) at rates of 1/8, 1/4, and 1/2 lb/A.

Results:

Table 1. 1953 Percent reduction in alfalfa stands when sprayed with herbicides.

Treatment	Percent reduction	Treatment	Percent reduction
MCP Na salt 2 oz	23	Dow Sel 3 qt in 40 gal.	17
MCP Na salt 4 oz	25	Dow Sel 3 qt in 80 gal.	17
MCP amine 2 oz	22	Sinox W 3 qt in 40 gal.	17
MCP amine 4 oz	23	Sinox W 3 qt in 80 gal.	19
MCP amine 6 oz	29	ACP 4-chloro 2 oz	26
MCP butyl ester 2 oz	35	ACP 4-chloro 4 oz	27
MCP butyl ester 4 oz	33	ACP 4-chloro 6 oz	30
2,4-D amine 2 oz	19	Check	5
2,4-D amine 4 oz	23		

Alfalfa plant counts were made before treatment and again on the same location after treatment. The DNOSBP treatments appeared to be less toxic to alfalfa than any of the other treatments. The higher rates of the 2,4-D amine, the MCP amine and butyl ester caused leaf deformaties on the alfalfa seedlings. The DNOSBP, MCP butyl ester and 4-chloro gave the best control of early weeds. However, later counts indicated that there was a re-infestation of weeds which was mostly Russian pigweed and Russian thistle. It would seem that a later application would be more satisfactory for weed control. (Contribution by the Dominion Experimental Station, Scott, Sask., 1953. Approved for publication.)

The effects of 2,4-D spray drift on sweet clover plants in the second year of growth. Greenshields, J. E. R. and W. J. White. In recent years, Saskatchewan farmers have complained of low sweet clover seed yields in spite of apparent good weather and adequate bee populations. Also, it has been observed that the seed set in the Dominion Forage Crops plots at Saskatoon has been late and very light. From a seeding made in 1952 approximately 250 plants of the variety Arctic were dug and transplanted in 7 in pots in the spring of 1953. When about twenty-five per cent of the flowers were open, the plants were taken to a large field of summerfallow and arranged in 5 replicates with 5 plants per plot. The distance between replicates was two rods. Treatment 1 was taken in from the field before spraying commenced to be used as a check. The plants in treatment 2 were placed at right angles to the wind as close as possible to the spray area. Plants in treatments 3, 4, 5, 6 and 7 were located 4, 12, 24, 48 and 96 rods respectively from the area to be sprayed and parallel to those in treatment 2. Spraying was carried out parallel to treatment 2 at a rate of 6 oz of acid equivalent of 2,4-D butyl ester/A for one hour, at wind velocities of 17-13 mph from the south-east.

Results: The 2,4-D spray drift resulted in shedding of leaves, distortion of leaves and stems and shedding of flowers. Even at 96 rods the effects were clearly discernible. The effects were sub-lethal in all cases, the primary effect being the delay of maturity of the seed. Seed yields taken 51 days after spraying were significantly different at the one per cent level of probability. The check yields averaged 25.1 gr/plot, while the other treatments yielded 2.3, 9.3, 9.8, 17.0, 17.2 and 18.9 gr respectively. The yield of seed does not reveal the complete picture. Seed quality improved with distance from the sprayed area but even at 96 rods was inferior to the check. This experiment probably underestimates possible damage from 2,4-D drift on sweet clover, because spraying was only for one hour at an average wind velocity of 15 mph, but many farmers spray larger areas at higher wind velocities. (Contribution from Dominion Forage Crops Laboratory, Saskatoon, Saskatchewan. Approved for publication.)

Chemical herbicide treatments on legume seedlings. Klingman, Dayton L. Thirty chemical treatments were applied May 11, 1953 to small legume seedlings (planted March 25, 1953). At the time of treatment, legumes ranged in size from cotyledonary stage for birdsfoot trefoil, 1-3 trifoliate leaves for Ladino, red clover, and alfalfa, and 3 true leaves for lespedeza. Weedy grasses emerged at that time were foxtail and spreading panic grass and ranged from 1-3 leaf stages of growth. Six chemical treatments gave 90% or better control of weedy grasses according to notes taken in July. They were: CIPC, 10 lb/A; TCA, 8 and 12 lb; DNOSBP (amine), 3 lb; CMU at 1 lb; and 2,4-D + TCA at 3/16 and 6 lb respectively.

Results: Legumes responded differently to chemical treatments. TCA at 8 and 12 lb almost complete eliminated the lespedezas with little injury to birdsfoot trefoil or alfalfa. Conversely, DNOSBP at 3 lb/A elinated birdsfoot trefoil with little injury to the lespedezas. CIPC did not appreciably injure any of the legume species. 2,4-D + TCA severely reduced stands of legumes and CMU eliminated all five species of legumes when applied at 1 lb/A. (Contribution of the Division of Weed Investigations, BPIS&AE, U. S. Dept. of Agriculture and Missouri Agricultural Experiment Station cooperatively. Approved for publication.)

Response of established legumes to herbicides. Miller, J. H. and R. S. Dunham. Two year old stands of alfalfa, and sweet, alsike, Ladino and red clovers were sprayed with the amine salt of 2,4-D (1/4 and 1/2 lb/A); amine salt of MCP (1/4 and 1/2 lb/A); and sodium salt of TCA (5 and 10 lb/A). The applications were made May 22 when the legumes were about 3-4 in tall.

Results: All of the legumes were severely injured by the 1/2 lb application of 2,4-D and all except Ladino clover were severely injured by both rates of MCP. Injury to red clover by MCP was considered moderate with 1/2 lb applications and slight with 1/4 lb applications. Alfalfa and sweet clover were not injured by 5 and 10 lb applications of TCA. Ladino clover was slightly injured by both rates of TCA. Alsike and red clovers were severely injured by both rates of TCA. Alfalfa treated immediately after hay harvest, was not injured by any of these treatments. Red clover treated immediately after hay harvest was not injured by 2,4-D or MCP at these rates but it was moderately injured by the 10 lb application of TCA. Alfalfa treated with 5 and 10 lb rates of CMU in June 1952, recovered completely from the 5 lb application and stands were not reduced by the 10 lb application. The plants were still displaying symptoms of injury in the fall of 1953. (Contribution of USDA, BPIS&AE, Division of Weed Investigations and Minn. Agric. Expt. Station, Dept. of Agronomy and Plant Genetics. Paper No. 3077, Sci. Jour. Series, Minn. Agri. Expt. Sta.)

Response of seedling legumes in flax to herbicides. Miller, J. H. and R. S. Dunham. Alfalfa and sweet, alsike, Ladino and red clovers seeded with flax were sprayed with amine salt of 2,4-D (1/4 and 1/2 lb/A), amine salt of MCP (1/4 and 1/2 lb/A), sodium salt of TCA (5 and 10 lb/A), and CMU (1 and 2 lb/A). The legumes at the time of spraying were in the following stages: Alfalfa and sweet clover, 4-6 trifoliate leaves; alsike and Ladino clovers - 2 trifoliate leaves; and red clover, 3-4 trifoliate leaves.

Results: Alfalfa stands were not reduced by either rate of 2,4-D, TCA, or CMU. They likewise were not reduced by 1/4 lb applications of MCP, but were reduced moderately by the 1/2 lb application. Sweet clover stands were not reduced by TCA, but were thinned by all other treatments. Stand losses were particularly severe with both rates of CMU and the 1/2 lb rate of 2,4-D and MCP. The response from 2,4-D and MCP was very similar. Alsike clover stands were not injured by either rate of 2,4-D or MCP, but were drastically reduced by both rates of CMU and TCA. Ladino clover stands were not injured by either rate of 2,4-D, MCP, or TCA; but were seriously reduced by both rates of CMU. Red clover stands were not reduced by either rate of 2,4-D or MCP but were moderately reduced by 5 lb of TCA and 1 lb of CMU and severely reduced by 10 lb of TCA and 2 lb of CMU. (Contribution of USDA, BPIS&AE, Division of Weed Investigations; and Minn. Agric. Expt. Station, Dept. of Agronomy and Plant Genetics. Paper No. 3076 Sci. Jour. Series, Minn. Agri. Expt. Sta.)

The effect of herbicides on alfalfa and sweet clover, 1953. Olson, P. J, and Burrows, V. D. In 1952, the following treatments were applied to sweet clover and alfalfa: 4 and 12 oz (acid equivalent)/A of MCP sodium salt; 4, 8 and 12 oz/A of MCP butyl ester; 2 and 4 oz/A of 2,4-D butyl ester; 4 oz/A of 2,4-D amine; and 1 gal of Sinox/A. The results from this experiment were given in the Research Report NCWCC, 1952, p.112. The experiment was left until the summer of 1953 for survival observations. Comparison of any of the treated plots with the check revealed no differences. (Contribution, Division of Plant Science, The University of Manitoba.)

Early post-emergence treatments of leguminous forage crops and Russian pigweed with eleven systemic herbicides. Series 2. Pavlychenko, T. K., and Bestrop, A. J. In seed alfalfa and clovers Russian pigweed is a most serious pest because it is difficult to separate the seed from that of the legumes. In this project an attempt has been made to find a chemical that can control the weed and yet be sufficiently tolerant to the legumes. Newly seeded alfalfa (Medicago sativa), sweet clover (Melilotus officinalis), red clover (Trifolium pratense), at a height of 1 1/2 in and purposely sown Russian pigweed (Axyris amaranthoides) when 3 in high, were treated with 2, 4 and 6 oz/A rates of butoxy ethanol ester of 2,4-D (Weedone LV4), ethyl ester of 2,4-D (Weedone Concentrate), amine salt of 2,4-D (Weedar 80), ester of MCP (ACP 904), amine salts of MCP (Weedar MCP and Weedar MCP 60), sodium salt of MCP (Methoxone), ester of para (ACP 903), amine salt of para (ACP 423), emulsifiable acid of 2,4-D (ACP 638) and beta napthoxyacetic acid (ACP 299). Moisture was good at seeding time but abnormally low in midsummer.

Results: In general, all the chemicals used including the mildest (Methoxone) were too severe on the legumes at 6 oz/A rates. On the other hand, some chemicals such as Methoxone, ACP 903 and ACP 423 at 2 lz/A were too mild on the weed. The low volatile ester, Weedone LV4, at 2 oz/A gave 100% kill of the weed and very substantial increases in yield of alfalfa and sweet clover. The low volatile ester of MCP (ACP 904) at 2 oz/A also gave 100% weed kill, was very tolerant to sweet and red clovers, but reduced the vigor of alfalfa. ACP 299 at 4 oz/A was particularly tolerant to alfalfa, but it failed to eliminate Russian pigweed. MCP and 2,4-D amines up to 4 oz/A were reasonably tolerant to the legumes, but mostly failed to control the weed satisfactorily. The ethyl ester (Weedone Concentrate) and the acid of 2,4-D (ACP 638) gave almost complete destruction of the weed, but were too severe to the legumes. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask. Approved for publication.)

Post-emergence treatments of leguminous forage crops and Russian pigweed with eleven systemic herbicides. Series 3. Pavlychenko, T. K., and Bestrop, A. J. In this series the same chemicals and rates were used as in Series 2 but the treatments were made one week later when the crops and weed were more advanced. The purpose of the project was to find out which of the chemicals used were selective enough to eliminate the Russian pigweed without seriously injuring the crops. Alfalfa (Medicago sativa), sweet clover (Melilotus officinalis), red clover (Trifolium pratense) and Russian pigweed (Axyris amaranthoides), all sown in rows, were treated with 2, 4 and 6 oz/A of butoxy ethanol ester of 2,4-D (Weedone LV4), ethyl ester of 2,4-D (Weedone Concentrate), amine salt of 2,4-D (Weedar 80), amine salts of MCP (Weedar MCP and Weedar MCP 60), sodium salt of MCP (Methoxone), ester of para (ACP 903,) amine salt of para (ACP 423), emulsifiable acid of 2,4-D (ACP 638) and beta napthoxyacetic acid (ACP 299).

Results: At this more advanced stage the resistance of Russian pigweed to all chemicals was markedly increased while the three legumes were more easily injured. Weedone Concentrate alone gave consistantly effective kill of the weed at all rates (98-100%), but both were very injurious to legumes. Weedone LV4 at 2 oz/A reduced the weed by 57% and was reasonably tolerant to legumes. Ester of MCP at 2 oz/A gave a high control of the weed and was quite tolerant to alfalfa and sweet clover. Other chemicals that gave highly significant control of Russian pigweed and only temporarily depressed the legumes were MCP amine salts (Weedar MCP and MCP 60) at 2 and 4 oz/A. Weedar 80 was very effective on the weed but seriously depressed the legumes. Methoxone, ACP 423 and 299 were highly tolerant to the crops, but did not control the weed. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask. Approved for publication.)

A summary of three years work on controlling Russian pigweed (Axyris amaranthoides) in leguminous forage crops with systemic and contact chemicals. Series 1, 1951-53. Pavlychenko, T. K. and Bestrop, A. J. Russian pigweed in forage legumes grown for seed constitutes a derious problem mainly on account of the difficulty in separating it's seed from that of the legumes. From 1951 to 1953 the following systemic and contact materials were used at various rates and dates both as pre- and post-emergence treatments on alfalfa, sweet and red clovers and Russian pigweed to find out if any of them may be selective enough at least to prevent seed formation in the weed without permanent injury to the crops: Esters, 2,4-D - ethyl (Weedone Concentrate) and butoxy ethanol (Weedone LV4), MCP - butoxy ethanol (ACP 904), 2,4-D and 2,4,5-T esters mixture (ACP 912), para - ACP 903; Amine salts, 2,4-D - Weedar 80, MCP - Weedar MCP and MCP 60, para - ACP 423; Acids, 2,4-D - micronized (ACP 472), emulsifiable (ACP 638), 2,4-D and 2,4,5-T acid mixture - ACP 926; beta napthoxyacetic acid - ACP 299; Acetanilide, 2,4-D - ACP 646A; semi-contact - NaTCA; contact - KCNO, CMU, IPC and CIPC. The rates were 1/2, 3/4, 1, 1 1/2, 2 and 3 lb/A in the post-emergence tests with the systemic chemicals used. NaTCA, KCNO were applied at 5, 10, 15 and 20 lb/A and CMU, IPC and CIPC at 10 and 20 lb/A.

Results: In 1951, only pre-emergence tests were conducted with most of the chemicals listed. Some of the treatments proved quite tolerant to legumes, but none was sufficiently effective on Russian pigweed. In 1952 both pre- and post-emergence treatments were made. The results from pre-emergence treatments generally were similar to those secured in 1951. In the post-emergence series several systemic chemicals were reasonably tolerant to the crops, but only partially effective on the weed. Butoxy ethanol ester of 2,4-D at 2 and 4 oz/A rates was the only chemical that produced very severe stunting (with no seed) or killed Russian pigweed, with slight temporary depression or no injury to legumes. Ethyl ester was even more effective on Russian pigweed, but depressed legumes much more. In 1953 only post-emergence treatments were made with the systemic herbicides listed, at two dates, when the legumes were about 1 1/2 and 3 in high respectively. At the earlier date the weed was more susceptible, therefore, in addition to Weedone LV4, butoxy ethanol ester and amine salts of MCP also gave good control of Russian pigweed with no permanent injury to legumes. Other materials were either too severe on legumes or too mild on the weed (Methoxone). In the second, later series, the weed was more resistant and the legumes were more seriously depressed, even by the materials safe at the earlier date. From this work it seems evident that the low volatile butoxy ethanol esters of 2,4-D and MCP at the low rates of 2 and 4 oz/A rate are sufficiently safe to legumes and more dependable in controlling Russian pigweed than amine or sodium salts of MCP or 2,4-D; the latter may be also effective if used when the weed and crops are very young. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask. Approved for publication.)

Pre-planting treatments of legumes with contact chemicals for wild oat control. Pavlychenko, T. K. and Bestrop, A. J. A piece of land was heavily infested with wild oats (Avena fatua), and divided in four parts marked A.B.C. and D. A and B were treated (and cultivated) immediately with 2 and 4 lb/A of IPC (isopropyl-n-phenyl carbamate), CIPC (isopropyl-n-(3-chlorophenyl) carbamate), 5 and 7 lb/A of TCA (ACP Grass Killer) and 1 1/2 and 3 lb/A of CMU (3-p-chlorophenyl-1-1-dimethylurea), applied in 26 gal of water and 26 gal of oil respectively. Two weeks later alfalfa (Medicago sativa), sweet clover (Melilotus officinalis), red clover (Trifolium pratense), and field peas (pisum spp.) were planted. C and D were treated in like manner but immediately prior to seeding of the legumes, also 2 weeks after the infestation.

Results: Of all the treatments used, IPC in oil at both 2 and 4 lb/A rates gave the best and highly significant control of wild oats (up to 95% reduction in stand and 93% in dry wt), followed by its applications in water (up to 88% reduction in stand and 85% in dry wt). CIPC also produced very noticeable reductions in the stand (up to 67%) and dry wts., (up to 54%), of wild oats, particularly in the oil series, but the remaining infestation was quite serious. The other treatments were still less effective. IPC treatments in water and oil at both rates gave consistently very high increases in the yield of alfalfa, sweet clover and peas. The yields of legumes were also significantly increased with all other chemicals excepting CMU. Alfalfa and peas showed more and sweet and red clover less resistance to all the chemicals tested. The fact that IPC, applied as pre-planting treatment, showed to be highly effective on wild oats and very tolerant to the two most important legumes, alfalfa and peas, may be of great importance to areas where a straight grain farming is unprofitable on account of wild oats. By introducing one or both of the legumes into the crop rotation in such areas, it might be possible to keep the weed under control in the grain crops following the legumes. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask. Approved for publication.)

GRASSES, INCLUDING PASTURES AND RANGES

Summary

Dayton L. Klingman

Certain systemic herbicides gave good topkill of pasture sage in 1952, however, no further treatment was applied in 1953 and all plots had recovered almost their original stand in 1953. Bromegrass stands were not improved, probably because of continued overgrazing. In an experiment with the same species in an overgrazed native pasture, initiated in 1953, the two pound per acre rate of the esters was consistently better than the one pound in the effect upon current years growth. The esters were superior to the amines. Stands of native grasses were improved in the more successful treatments.

In a comparison of chemicals for selective control of nimblewill in bluegrass the relative toxicity of phenyldimethylurea and CMU was appraised. CMU was clearly more toxic to both of the grasses in this test and neither showed promise for selective control of nimblewill.

Effect of systemic herbicides on pasture sage (Artemisia frigida), 1952 - 1953. Pavlychenko, T. K., Bestrop, A. J. Plots 8x100 ft., in a brome grass overgrazed pasture, were treated in the late flowering stage with 1½ and 3 lb/A rates of ethyl ester (Weedone Concentrate) and butoxy ethanol ester (Weedone LV4) of 2,4-D both at 40 and 9.6 pct. concentration, another butoxy ethanol ester of 2,4-D (ACP 129), pentasyl ester of 2,4-D (ACP 649), amine salt of 2,4-D (Weedar 80), amine salt of MCP (Weedar MCP), mixture of 2,4-D and 2,4,5-T ester (Brush Killer 32), mixture of 2,4-D and 2,4,5-T acids (ACP 926), ester of para (ACP 903) and ester of MCP (ACP 904). Moisture conditions were fair throughout the season. RESULTS: 1952 results were given in the 1952 NCWCC Research Report. At that time Weedone LV4, ACP 129, Weedone Concentrate Dilute and ACP 649 gave a good kill of top growth and the new shoots showed strong abnormalities. The remaining chemicals were less effective in killing tops and the new shoots were almost normal. No further treatments were applied in 1953, and the pasture sage had recovered in all plots almost to the extent of the original population. Brome grass stand was not significantly improved. The fact that the pasture was not protected from heavy grazing and trampling after the treatments may have contributed materially to the poor results recorded in 1953. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Sask.)

Effect of systemic herbicides on pasture sage, (Artemisia frigida), 1953. Pavlychenko, T. K., Bestrop, A. J. Plots 8x125 ft. in size, located on overgrazed native prairie pasture, were treated in the early flowering stage with 1 and 2 lb/A rates of butoxy ethanol esters (Weedone LV4) and ethyl esters (Weedone Concentrate) of 2,4-D both at 40 and 9.6 pct. concentration, amine salts of 2,4-D (Weedar 80 and ACP 127), amine salt of MCP (Weedar MCP) and mixture of esters of 2,4-D and 2,4,5-T (Brush Killer 32). RESULTS: The 2 lb/A rates of Weedone Concentrate Dilute, Weedone LV4, Weedone LV4 Dilute, Brush Killer 32 and Weedone Concentrate produced stem kills of 97 to 82 pct. In the fall the regrowth from crowns was from 50 to 30 pct. The 1 lb/A rates of the above chemicals gave still lower stem kill amounting to 65 or 50 pct., and the regrowth, 75 to 20 pct. The remaining group of treatments gave relatively poor topkill, 25 to 10 pct., and about the same amount of regrowth. In the more effective treatments, the stand of native grass was much improved, but no improvement was recorded in the less effective treatments. (Contributed by Agr. Div. American Chemical Paint Company, Saskatoon, Saskatchewan.)

DATA

Treatment	Rate lb/A	Stem Kill %	Regrowth %
LV4	1	65	75
LV4	2	95	30
LV4 Dil.	1	62	72
LV4 Dil.	2	95	33
W.C.	1	50	20
W.C.	2	82	50
W.C. Dil.	1	50	20
W.C. Dil.	2	97	35
Weedar 80	1	20	15
Weedar 80	2	25	12
ACP 127	1	18	15
ACP 127	2	22	15
MCP	1	10	10
MCP	2	15	11
BK 32	1	50	40
BK 32	2	85	30

NOTE: LV4 - butoxy ethanol ester of 2,4-D; LV4 Dil. - LV4 reduced to 9.6 pct. ac. eq.; W.C. - Weedone Concentrate; W.C. Dil. - W.C. reduced to 9.6 pct. ac. eq.; Weedar 80 - and ACP 127 - amine salts of 2,4-D; BK 32 mixture of esters of 2,4-D and 2,4,5-T.

The relative toxicity of phenyldimethylurea and CMU when applied for selective control of nimblewill in bluegrass sod. Klingman, Dayton L. In a screening test for selective control of nimblewill (Muhlenbergia schreberi Gmel) in bluegrass sod a large number of chemicals were applied April 20th, 1953. Among those applied were both CMU and phenyldimethylurea (PDU) each at rates of 2, 4 and 8 pounds per acre. The relative toxicity of these two chemicals was appraised. Phenyldimethylurea was less toxic than CMU in this test. PDU gave injury to bluegrass of 26, 49 and 49%, respectively for the 2, 4 and 8 pound rates; CMU, 62, 90 and 95%, respectively. On nimblewill PDU gave 16, 22 and 31% injury at 2, 4 and 8 pounds, respectively, and injury by CMU was 35, 59 and 81%, respectively. (Contribution of the Division of Weed Investigations, BPIS&AE, U. S. Department of Agriculture and the Missouri Agricultural Experiment Station cooperating.)

SUGAR BEETS

Summary — E. A. Helgeson

From the five abstracts received plus two duplicates (Andersen and Smits, entered by Dunham) relatively few conclusions can be drawn, especially since time of application varied considerably.

Weed Control: Pre-planting treatments with IPC at rates from 3 to 6 lb/A gave good control of wild oats. TCA at 4-6 lb/A was ineffective and Endothal at 6-12 lb/A gave excellent control of green foxtail and mustard and fair control of wild oats in Manitoba. In Colorado TCA and DCU were effective on Setaria and Echinochloa.

Pre-emergence applications of IPC were ineffective on weeds in general, TCA was an excellent herbicide for the control of Setaria spp. and smartweed. Endothal controlled about 50% of a stand of wild oats and 100% of Setaria and mustard. Natrin was not effective on any weeds. T-516 controlled broad-leaved weeds better than grasses. Alanap compounds controlled ragweed and foxtail but not smartweed. CMU was slightly more effective for weed control than Urab.

Post-emergence applications of IPC were ineffective in weed control in field trials but fairly effective in greenhouse trials. TCA was not effective on wild oats but did control foxtail. Endothal gave about 50% control of wild oats and complete control of foxtail and mustard.

Reactions of Sugar Beets: The following chemicals caused no apparent permanent injury to beets: IPC, TCA, dichloral urea, hexachloroacetone, trichloroacetylurea, trichloroacetanilide, sodium trichloroacrylate, and a,a-dichloropropionic acid. Endothal reduced yields and sugar content and Alanaps, CMU, Urab, Natrin, T-516, and maleic hydrazide caused moderate to severe injury to beets.

Abstracts of Results of Cooperators

Endothal on weed free sugar beets at various rates and stages of growth. Andersen, R. N., and Helgeson, E. A. Beets in this test were planted approx May 4, 1953 in a field of Fargo Clay. A split-plot design with 6 replications was employed with stage of growth as main plots and rates of application as subplots. Plots were kept free of weeds by wheel-hoeing and pulling as needed. Disodium 3,6,endoxohexahydrophthalate (Endothal) was applied in 40 gal of aqueous solution at 0,2,4,6,8, and 12 lb/A when the beets were in the 2-3 leaf, 8-12 leaf, 14-18 leaf, and 18-24 leaf stage. The yield data are summarized in the following table in which * and ** indicate a significant reduction from the check at the 5% and 1% of level of probability, respectively.

Treatment	Yield of Beets in Tons per acre and percentage of check								
	2-3 leaf stage		8-12 leaf stage		14-18 leaf stage		18-24 leaf stage		Av.
	Tons	%	Tons	%	Tons	%	Tons	%	Tons
Check	14.89	-	14.54	-	14.09	-	14.02	-	14.38
Endothal 2 lb/A	12.80**	86	13.45	92	12.92**	92	13.10	93	13.07**
Endothal 4 lb/A	12.04**	81	12.85**	88	11.54**	82	12.46**	89	12.22**
Endothal 6 lb/A	10.43**	70	11.47**	79	11.76**	83	11.25**	80	11.22**
Endothal 8 lb/A	10.11**	68	11.35**	78	11.01**	78	10.82**	77	10.82**
Endothal 12 lb/A	6.84**	46	10.27**	71	9.53**	68	10.39**	74	9.26**

Sugar percentages varied considerably even between plots treated alike. However there appeared to be a slight reduction in sugar content due to the application of Endothal. (Div. of Weed Invest. B.P.I.S.A.E., U.S.D.A., and North Dakota Agr. Exp. Sta.)

Effect of various heribicides on sugar beets. Helgeson, E. A., and Andersen, R. N. Ten herbicides were applied to randomized duplicate rows of unblocked sugar beets at the rate of 2 and 8 lb active material/A on July 3, 1953 at which time the beets were in the 12 leaf stage. All materials were applied in 40 gal of aqueous spray mixture/A. Observations on degree of injury were made on Aug. 10, 1953. The following chemicals gave no apparent injury to the beets: dichloral urea (EH -2), hexachloroacetone (Cpd. 1106), trichloroacetylurea (Cpd. 2015), trichloroacetanilide (Cpd. 2025), sodium trichloroacrylate (E.C. 3890), disodium 3,6,endoxohexahydrophthalate (Endothal), and the sodium salt of TCA. The only apparent injury from a,a-dichloropropionic acid (Dalapon) was a slight "burn" on the leaf tips and edges. Sodium salt of maleic hydrazide (MH-40) at 2 lb moderately reduced the height of the beets while causing the development of narrow leaves. At 8 lb MH-40 resulted in nearly complete kill of all the beet plants. N-1 naphthyl phthalamic acid (Alanap 1) at 2 lb resulted in a reduction in height of approx 40%, and a killing of the lower leaves. At 8 lb Alanap 1 nearly eliminated all the beet plants. (North Dakota Agr. Exp. Sta. and Div. of Weed Invest. B.P.I.S.A.E., U.S.D.A.)

Pre-emergence weed control in sugar beets. Ilnicki, R. D. and Willard, C. J. Triplicated 4-row plots 30 feet long were laid out at the Northwestern Substation of the Ohio Agricultural Experiment Station. Beets were planted on Hoytville clay soil, April 23, 1953, and treated April 30. The following compounds were used, usually at 3 rates each: STCA, T-516, Natrin, Alanap 1, Alanap 3, CMU, and Urab. (Commercial names used to save space.) All herbicides were applied in 40 gallons spray per acre. 0.51 inch of rain fell between spray application and beet seedling emergence on May 7. Lady's thumb smartweed, common ragweed, and yellow foxtail were the most important weeds. As in past years, TCA was the most effective material used. Five and 7½ lb/A gave grass control and good smartweed control; 10 and 15 lb/A stunted the beets, but they outgrew it. T-516 stunted the beets, but the effect was outgrown. It controlled broad leaves better than grass. Natrin was ineffective on weeds and stunted and killed the beets. The Alanap compounds killed most of the beets and were ineffective on smartweed though effective on ragweed and foxtail. CMU killed 90 percent of the beets at 2 lb/A and 15 percent at 1 lb/A. One-half lb/A did not reduce the stand and controlled about 30 percent of all weeds. Urab was more toxic to beets and gave slightly poorer weed control than CMU. The beets died about a month after emergence following a 5-day rainy period in which 2.2 inches of rain fell. Seedlings in the plots treated with CMU died at the same time. Yields will be determined later. (Contribution of Ohio Agricultural Experiment Station.)

Test results and observations on IPC, TCA, and DCU as used for grass control in sugar beets. Nelson, Russell T. During 1953 IPC was used commercially on 4800 acres of sugar beets as a pre-plant, soil incorporation, treatment for control of wild oats and volunteer grain. Very good control of wild oats, barley, tame oats and wheat was experienced on more than 85% of the fields treated within the areas served by The Great Western Sugar Company. Applied rates fluctuated considerably from the recommended rate of 3 lbs/a under farmer use without ill effect on sugar beets. A date of application test with IPC was started at Longmont, Colorado, February 3, 1953, and continued to May 14. Results of this test and observations on the commercial use of IPC showed that under conditions of cool temperature the effect of IPC on grass is characterized by a long slow, but progressive toxicity lasting over a several-week period. Under conditions favorable to rapid growth, IPC is acute in its toxicity usually killing wild oat and grain seedlings before they reach the surface of the soil. The effectiveness of DCU and TCA was compared on eight fields for control of foxtail (Setaria), and barnyard grass (Echinochloa). Rates of 7.3 and 14.6 pounds DCU and 7.2 pounds TCA were used per acre sprayed on soil and disked or harrowed into soil surface prior to planting sugar beets. Control of grass was good with all treatments on all except one field. On this one field DCU gave excellent control and TCA gave no visible control. Pre-thinning stand counts showed TCA to be more injurious to sugar beet than DCU. Harvest results obtained on two fields showed neither chemcial had an adverse effect on sugar production. (Contribution of The Great Western Sugar Company, Agr. Experiment Station, Longmont, Colorado.)

Post-emergence control of wild oats with IPC. Sexsmith, J. J. Duplicate post-emergence treatments of IPC (emulsifiable) at 2,3, and 5 lb/A were applied to 33 x 75 ft. plots of sugar beets on heavy loam soil, when beets were in the cotyledon to early two-leaf stage and the wild oats up to 4 inches tall with two to four leaves. Stands of sugar beets were taken on five 100-inch row lengths per plot, and of wild oats for same row lenghts to width left after one cultivation. Recounts were made 16 days after treatment, immediately prior to hand blocking and thinning. Three inches of rain fell on plot area during 36-hour storm which began 4 hours after treating. Beet stands 16 days after treatment, expressed as percent of original, were: Check 85, 2 lb. IPC 87, 3 lb. IPC 88, 5 lb. IPC 84. Wild oats kills at same date were: 2 lb. IPC 28, 3 lb. IPC 41, 5 lb. IPC 53. Thus, a fairly good control of wild oats was obtained without damage to the beets. Not only was the actual kill reasonably good, but treatment reduced vigor of wild oats, and height was reduced to 1/3. Conditions for blocking and thinning were improved greatly by 3 and 5 lb. treatments. No yield determinations were made, but at harvest no difference was seen as a result of treatments. Sugar content was not affected by treatments. (Dominion Experimental Station, Lethbridge, Alberta.)

ONIONS, POTATOES, AND SWEET CORN

R. E. Nylund

Summary

Twelve abstracts on weed control in onions, three on potatoes, and one on sweet corn were received.

Of the large number of herbicides tested for pre-emergence weed control in onions only Stoddard solvent, CIPC, and sulphuric acid gave fair to good weed control without injury to crop plants. CIPC appears to be especially promising for control of smartweeds (Polygonum sp.) but gave variable control of pigweed (Amaranthus retroflexus), and poor control of lambsquarters (Chenopodium album) and annual grasses. The effectiveness of CIPC was improved, in several ixperiments, by mixing with it various herbicides such as CMU, Stoddard solvent, 2,4D, or NIX. In most experiments in which it was used, CMU at 2 lb per acre gave good weed control without crop damage. However, in a few instances reduced stands and yields were reported. In one study, reduced yields were obtained only in instances where CMU applications was delayed until onions were emerging. Variations in rainfall following CMU applications apparently were not associated with variations in toxicity to CMU to onions. Herbicides related to CMU - dichlorophenyl dimethyl urea, dichlorophenyl methyl urea and phenyl dimethyl urea - were tested to a limited extent. Good control of broadleaved weeds but poor control of grasses were obtained at rates of 2 and 4 lbs. Toxicity of these materials to onions was variable. Xanthogen disulphide at 10 lbs gave inconsistant results, but, in general, it gave poor weed control and/or crop damage. E.H.3 at 6 gal gave good weed control without apparent crop damage, at higher rates reduced yields. Sodium isopropyl Xanthate (NIX) reported in two tests gave crop injury in one test but good weed control in both. A few herbicides were reported in single tests. Monosodium cyanamid gave poor weed control; 2,4D ester at 1/2 lb gave fair weed control without crop injury; and trichlorobenzoic acid (isopropyl ester) controlled purslane and lambsquarter but not pigweed, smartweed and grasses without crop injury.

For post-emergence weed control in onions CMU was most extensively tested. In general it gave excellent weed control when applied at 2 lb per acre over the top of onions in the "flag" to 2-3 leaf stage and when used as a basal spray at lay-by. However, in a few instances weed control was poor or serious crop damage resulted. Potassium cyanate gave variable weed control and variable crop injury. CIPC at 8 to 12 lb, as in pre-emergence applications, controlled some weed species but not others. Mixtures of CMU with CIPC or endothal appear to be more effective than those herbicides applied singly. E.H.3 at rates of 4 to 8 gal appears to have promise as a post-emergence weedicide. DNBP gave variable results in the control of purslane when applied as a basal spray at lay-by. Endothal, N-1-naphthyl phthalamic acid, and dichlorophenyl methyl urea all injured onions at the rates used. Other materials tested but which gave poor weed control were: 25 lb monosodium cyanamid, 8 lb trichlorobenzoic acid (ester), 4 lb TCA, and dichloropropionic acid (amine) at 1, 2, and 4 lb.

Pre-emergence weed control in potatoes with 1 1/2 to 3 lb CMU or with various formulations of 2,4D at 1 and 2 lbs was excellent with no reduction in yield. DNBP (alkanolamine salt) at 3 lbs gave only fair weed control. N-1-naphthyl phthalamic acid at 8 and 12 lbs applied to emerging potatoes growing on muck soil not only gave poor weed control but severely injured potato plants. Application of 1/2 lb of MCP (ester, amine, or sodium salt) or 1/4 lb 2,4D (amine) to potatoes in the 4-5 leaf stage gave good control of stinkweed (Thlaspe arvense) without reducing potato yields.

CMU and phenyl dimethyl urea applied at 1 lb per acre to sweet corn as pre-emer-

gence sprays did not injure the corn but failed to give good control of weeds present which were primarily annual grasses. SES at 4 lbs and DNBP (alkanoline salt) at 3 lbs were applied post-emergence to corn 3 to 5" tall. The former gave poor weed control and the latter, while effective against the grassy weeds present, reduced yields of corn.

Abstracts

Onions

Chemical weed control in onions. Hemphill, D. D. Onions, variety Yellow Globe, were treated with CMU, 1 pound per acre and Phenyldimethyl urea 1 pound per acre one day after seeding and four weeks later. KOCN, 8 pounds per acre, was applied post-emergence (knee stage) and again 4 weeks later. N-1 naphthyl phthalamic acid (NPA) 6 pounds per acre was applied post-emergence and repeated 4 weeks later at the rate of 3 pounds per acre.

Season was extremely hot and dry. All treatments seriously reduced stands. CMU plots showed the greatest reduction of stand (78 percent) with KOCN showing the least (45 percent). (Contribution of Department of Horticulture, Missouri Agricultural Experiment Station, Columbia, Missouri. Journal Series No. 1391.)

Weed control studies with onions, Lana, E. P. and D. W. Staniforth. Pre-emergence treatments of 2,4D ester 1/2 lb/A and CMU at 1/2, 1 and 2 lb/A were applied three days before general onion emergence. The plots were weed-free at that time. The 2,4D treated plots gave fair residual control for about one month after onion emergence (May 10). Cmu gave increased residual control as rate was increased. However, plant mortality increased with rate. EH3 in the crude and formulated state was applied twice during the season as post-emergence sprays in concentrations ranging from 2.5 gal/100 gal H_2O to 10 gal/100 gal H_2O per A. Plants receiving 10 gal 3-5 in. tall and in the 3-4 leaf stage. Other rates of EH3 gave good weed control until purslane began to appear. The onions showed injurious effects with increase of EH3 to water ratio. 1% KOCN and Sulfasan 20 lb/A did not control weeds. Sulfasan 40 lb per acre gave fair control on small weeds. A late summer directional spray was applied to attempt to eradicate established purslane. 2 and 4 lb of CMU and EH3 10 gal in 50 gal H_2O and 20 gal in 50 gal H_2O did not retard purslane growth. 6 and 12 lb KNBP (alkanol amine) had some effect in reducing purslane stand. EH3 significantly reduced yields in combined dosages totaling 10 gal/A and above. CMU, despite a reduction in total yield, compared favorably with the handweeded check in marketable onions (over 1 1/2" diameter). (Iowa Agricultural Experiment Station, Ames, Iowa.)

Pre-emergence weed control in onions grown in muck soil. Nylund, R. E. In 1953, Brigham Yellow Globe onions seeded on muck on April 23 were sprayed with 11 herbicides applied 15 days after seeding but prior to onion emergence. Because of a heavy rain (1.46" in 15 minutes) which temporarily inundated the field two days after the herbicides were applied it was feared that the field would have to be abandoned and thus a second planting was made on May 19 and the same 11 herbicides were applied to this planting 9 days after seeding. However, the first field was saved and weed control data, stands and yield of onions were obtained from both plantings making possible a comparison of the effects of excessive precipitation versus normal precipitation on toxicity of herbicides. The 11 herbicide treatments were: 10 and 20 gal EH3, 2 lb CMU, 80 gal Stoddard solvent, 20 lb KOCN, 2 lb CMU 4 lb CIPC, 12 lb NIX, 4 lb and 8 lb CIPC, and 5 and 10 lbs xanthogen disulphide. Differences in weed control between the various treatments were not statistically significant for the early

planting but varied from 13% (for 4 lb CIPC) to 61% (for 10 gal E.H.3). In the late planting all treatments except Stoddard solvent, KOCN, and CIPC significantly reduced weed populations with the most effective treatment being the mixture of CMU and CIPC (68% control), 10 lb xanthogen disulphide (62%), CMU (58%) and NIX (57%). Stands and yields of onions were not significantly affected by any of the herbicide treatments in either planting but E.H.3, CMU + CIPC, NIX, and 10 lb xanthogen disulphide tended to reduce stands and yields in the late planting. The heavy rain which fell two days after herbicide applications were made, while it did not completely eliminate the effect of the herbidides on weeds, did tend to reduce the differences in toxicity of the herbicides. (Paper No. 3068 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.)

The relation of date of planting and date of application to the toxicity of CMU to weeds and onions. Nylund, R. E. Brigham Yellow Globe onions were seeded on muck soil on May 19, May 22, May 25, and May 28. To separate plots in each of these seedings CMU at the rate of 2 lb per acre in 100 gal water was applied on the day of seeding, 3 days after seeding, 6 days after seeding, and 9 days after seeding. Each plot, consisting of a single row one rod long, was replicated five times. Weeds were counted in all plots on June 16, ten days after the last treatment was applied in the May 28th seeding. Stands and yields of onions were obtained at harvest on September 15. The degree of weed control obtained was directly related to the presence of weeds in the field. Prior to May 31, very few weeds had emerged and weed control was relatively poor. By May 31 numerous weeds had emerged and CMU treatments applied on this day or later gave excellent weed control. Injury to onions, as reflected in stands and yields, occured only in the May 28 planting in plots sprayed 9 days after seeding. Onions in these plots were about 50% emerged and in the early loop stage when sprayed. However, in both the May 22 and May 25 plantings, in spite of the fact that onions were partly emerged when CMU was applied no injury to onions occured. Examination of the precipitation record forthe 6 day periods immediately preceding and following the CMU applications failed to reveal any differences in rainfall which could have accounted for the inconsistent toxicity of CMU to onions. However, abnormally high temperatures beginning about June 10 and continuing for approximately three weeks may have adversely affected the development of the young onion plants and thus prevented their recovery from the effects of the CMU treatment. (Paper No. 3082 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.)

Toxicity of CMU and E.H.3 to onions sprayed at various stages of development. Nylund, R. E. Brigham Yellow Globe onions seeded on muck soil were sprayed with 1 lb and 2 lb of CMU at each of three stages of growth: (1) late "loop" stage, (2) two true leaf stage, and (3) 6-7 leaf stage when onions had bulbs to 1" diameter. E.H.3 at 4 gal and 8 gal was applied to onions in the first and last of the above stages. Each plot consisted of a single one rod row and each treatment was replicated five times. Rainfall varied considerably during the six-day periods following herbicide applications being 0.12", 1.76", and 3.42", respectively, following the three stages of growth given above. Weed counts were made two weeks after the "loop" stage applications only. All plots were then hand-weeded and kept free of weeds by hand weeding for the remainder of the season. Effects of the treatments on the onions was measured by yield data obtained at harvest on September 15. Statistically significant weed control was obtained with both rates of both chemicals applied at the "loop" stage, the percent control being 61, 90, 51, and 78% for the 1 lb CMU, 2 lb CMU, 4 gal E.H.3, and 8 gal E.H.3 treatments, respectively. None of the treatments, regardless of stage of onion growth when applied, significantly affected onion development as measured by yields of marketable onions. (Paper No. 3067 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.)

The effects of repeated applications of CMU on yields of onions. Nylund, R. E. Brigham Yellow Globe onions seeded in muck soil on April 23, 1953, were sprayed with 1.6 lb of CMU (2 lb 80% formulation) in 100 gal water per acre on May 28 (one true leaf stage), on June 22 (4-5 leaf stage), and on July 20, (8-leaf stage bulbs to 1 1/2" diameter). Each treated plot received all three applications. The first application was applied over the rows in all plots, and the second and third applications were sprayed over the tops of the rows in half of the sprayed plots and as basal sprays in the remaining sprayed plots. Thus, there were three treatments as follows: (1) unsprayed, (2) sprayed over the rows, and (3) basally sprayed. Each plot consisted of three one-rod rows and applications were made at 35 p.s.i. pressure using fan-type nozzles on a knapsack sprayer. Yields of the basally sprayed onions were 96% of the unsprayed, the difference being statistically insignificant. Yields of the plots sprayed over the rows were significantly lower than the unsprayed plots being 80% of the unsprayed. Thus, under the conditions of this experiment, onions were not materially affected by three 1.6 lb applications of CMU, applied approximately one month apart, in which the first application was made over the row and the later treatments were applied as basal sprays. (Paper No. 3065 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.)

A study on the effects of pre-emergence, early post-emergence, and late post-emergence applications of herbicides on weed control and yields of onions. Nylund, R. E. Yellow Globe onions seeded on muck soils at four locations in southern Minnesota received the following pre-emergence, early post-emergence, and late post-emergence treatments applied alone and in all possible combinations: (1) pre-emergence: untreated, 80 gal Stoddard solvent, or 2 lb CMU per acre: (2) early post-emergence (onions in 1-2 leaf stage): untreated, 12 lb KOCN, or 2 lb CMU per acre: (3) late post-emergence (lay-by): untreated, 1.875 lb DNBP, or 2 lb CMU per acre. The nine combinations of pre-and early post-emergence treatments were applied to randomized single row plots within larger late post-emergence plots in a split plot arrangement. Each of the 27 treatments was replicated twice at each location. Weeds were counted 2 to 4 weeks after each application and all plots were handweeded immediately following the weed counts. Of the pre-emergence treatments, Stoddard solvent gave an average weed control of 20% and CMU, 62%. Of the early post-emergence treatments, KOCN gave 56% and CMU gave 85% weed control. Of the lay-by treatments, DNBP gave 45% and CMU gave 74% weed control. Yields of onions were not significantly different at the three locations at which yield records were obtained. Likewise, the lay-by herbicide treatments did not significantly affect yields. However, statistically significant differences in yield were obtained among both pre- and early post-emergence treatments. CMU applied as a pre-emergence treatment reduced yields of onions an average of 22% while Stoddard solvent tended to reduce yields only slightly. CMU applied as an early post-emergence treatment reduced yields by 21%, and KOCN reduced yields 13%. Both KOCN and CMU when applied as early post-emergence treatments to plots treated one month earlier with CMU caused considerably greater reductions in yield than when applied to previously untreated plots. However, when the pre-emergence application of CMU was followed by an application of either DNBP or CMU 8 to 10 weeks later, the onions were not injured by the latter treatments. (Paper No. 3081 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.)

Pre-emergence weed control in onions. Shadbolt, C. A. and Holm, L. G. Downing Yellow Globe onions were sown in organic soil on June 24 in a replicated randomized block experiment. On July 1, immediately prior to emergence, the following chemicals were applied: Weed Killer M (1-(3,4-dichlorophenyl)-3-methyl urea) 2 and 4 lbs; Weed Killer D (3-(3,4-dichlorophenyl)-1, 1-dimethyl urea) 2 and 4 lbs; CMU (3-p-chlorophenyl 1, 1-dimethyl urea) 2 lbs.; and the mixtures of CMU 1/2 and 1/4 lb with CIPC 3 lbs; and CMU 1 lb with CIPC 3 lbs. The amount of each chemical is ex-

pressed in pounds per acre of acid equivalent or active ingredient. Each chemical was applied in 40 gallons of solution per acre and at a pressure of 30 p.s.i. Because of the unstable nature of the CMU with CIPC mixtures, each chemical was applied separately in a total solution volume of 80 gal per acre. Eighty-five to 100 percent control of broadleaf weeds was obtained with all rates of Weed Killer D and CMU, and the mixtures of CMU and CIPC. The treatments with Weed Killer M gave between 70 and 85% control of all broadleaf weeds. Ninety to 100% of the pigweed (Amaranthus retroflexus) was controlled by all of the treatments except the mixture of CMU 1/4 with CIPC 4 lbs. The latter treatment gave 81% control. Purslane (Portulaca oleracea) was controlled satisfactorily by all rates of Weed Killer D and CMU, and the mixture CMU 1/2 with CIPC 4 lbs. Grass weeds, viz. crabgrass (Digitaria sp.) were not controlled satisfactorily by any treatment. The onion stand with Weed Killer D at 4 lbs was significantly reduced by 56%. Yield of mature onions was not available because of the late planting. Herbesan and X5 (monosodium cyanamid, soluble) were also included in this study and no satisfactory weed control was obtained.

An experiment similar to the one outlined above was planted 6 weeks earlier in the same area. This study included in addition, mixtures of CMU with Endothal as well as CIPC with Endothal. Only a trace of precipitation occurred during the 3 weeks following planting and as a result there was no effective weed control. It appears from these studies that CMU and the mixture of CMU with CIPC shows much promise for the pre-emergence control of weeds in onions, when applied under normal moisture conditions. (Department of Horticulture, Agricultural Experiment Station, Madison, Wisconsin.)

Post-emergence weed control in onions. Shadbolt, C. A. and Holm, L. G. Downing Yellow Globe onions were sown in organic soil on May 20 in a four replicated randomized block experiment. The following treatments were made on June 11 when the onions were in the advanced flag stage: Endothal (3,6-endoxohexahydrophthalate) 2 1/2, 3 1/2, and 4 1/2 lbs; CMU (3-p-chlorophenyl 1, 1-dimethyl urea) 1, 1 1/2, and 2 lbs; Weed Killer M (1-(3,4-dichloro henyl)-3-methyl urea) 1 1/2 and 2 lbs; X5 (monosodium cyanamid, soluble) 25 lbs; KOCN 10 lbs plus wetting agent; and the mixtures CMU 1 lb with CIPC 3 lbs; CMU 1 lb with endothal 2 lbs; CMU 1/2 lb with endothal 2 1/2 lbs; and CMU 1/2 lb with KOCN 10 and 14 lbs. The concentrations of the chemicals are expressed in pounds per acre of acid equivalent or active ingredient. They were all applied in 40 gallons of solution per acre, with a pressure of 30 p.s.i. Ninety-five to 100% of the smartweed (Polygonum Persicaria) was controlled by the CMU with Endothal mixtures and by Endothal at all rates. The remaining treatments gave less than 40% control of this weed, with the exception of CMU 2 lbs which gave 50% control Pigweed (Amaranthus retroflexus) was controlled to the extent of 95 to 100% by all rates of CMU, the CMU with Endothal mixtures and by both rates of Weed Killer M. The remaining treatments, except X5 and KOCN, gave better than 80% control of this weed. Onion stands were significantly reduced by 30 to 40% by the high rates of CMU, Endothal and Weed Killer M as well as by the mixtures of CMU with CIPC and KOCN. Significant reduction in yield of mature onions (35 to 40%) resulted from treatments with Endothal 3 1/2 and 4 1/2 lbs, Weed Killer M at both rates, and the mixture of CMU 1 with Endothal 2 lbs.

The use of another herbicide with CMU for post-emergence weed control in onions appears very promising. In this experiment, combinations of CMU with Endothal and CIPC provided 90 to 95% control of two of the most serious weeds on muck soils, whereas CMU alone was unsatisfactory. In other experiments these combinations have been equally effective on annual grasses. Additional work will be required to determine the rates which will be most satisfactory from the standpoint of crop tolerance. Injury to the crop was more severe this season than previously becuase the

crop was under water for about 3 days in early June. (Department of Horticulture, Agriculture Experiment Station, Madison, Wisconsin).

Pre-emergence weed control in onions. Warren, G. F. and Larsen, J. E. Early Yellow Globe onions were seeded about 1 1/2 inches deep in muck soil on April 7. On April 27, just prior to emergence, the following treatments were applied: CIPC, 8 lb; CMU, 2 and 4 lb; isopropyl ester of trichlorobenzoic acid (TCB), 8 lb. The treatments were replicated 4 times and were applied in water at 50 gal/A. At time of spraying the sky was clear, the temperature 49°F and the soil wet. Only light showeres occured during the next 2 weeks and totaled 1.23". All plots were hand weeded and cultivated throughout the season. Weed counts made May 28, and the stand and yield of onions are shown in the table below:

		No. weeds/sq ft			No. weeds/100 sq ft			No. 1 onion
Herbicides	lbs/A	Pigweed	Purslane	Grass	Smartweed	Lamb's Quarters	per ft of row	bu/A
Check		23.9	22.3	39.1	72.8	33.0	9.8	775
CIPC	8	23.8	4.4**	19.1	.0**	3.0**	9.8	754
CMU	2	10.8*	11.7**	25.6	155.0	6.3**	9.4	759
CMU	4	3.8**	3.4**	20.0	94.0	6.8**	8.5	681
TCB	8	25.0	2.9**	44.0	34.3	.8**	9.7	813
	L.S.D.		5%		N.S.		N.S.	98

* and ** significantly lower than the check at the 5% and 1% levels respectively.

In addition to the weed kill shown above, TCB caused severe stunting of the pigweed. There was no apparent injury to the onions except from 4 lb of CMU which caused noticeable stunting about 4 weeks after treatment. The results are similar to those obtained in other experiments except that lamb's quarters has usually not been killed by CIPC. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana.)

Tolerance of onions to herbicides applied as post-emergence sprays. Warren, G. F. and Larsen, J. E. Early Yellow Globe onions in the 2 to 3 leaf stage growing on muck soil were hand weeded about 10 days before the following treatments were applied on June 12: CIPC 8 lb/A; CMU, 3 lb; isopropyl ester of trichlorobenzoic acid, 8 lb; N-1 naphthyl phthalamic acid, 8 lb; TCA sodium salt, 4 lb acid equivalent alpha, alpha, dichloropropionic acid, amine salt, 1, 2, and 4 lb acid equivalent/A. All herbicides were applied in water at 50 gal/A and were directed so that only the lower 3 to 4 inches of the onion plants were hit by the spray. The first 3 herbicides listed were also applied over the top of the onions. Treatments were replicated 4 times. The temperature was 87°F, the sky clear and the soil surface dry when the treatments were applied. There was no rain during the next 11 days but 2.34 inches fell on the 12th day. Notes taken on weed control 5 days after spraying indicated good kill of pigweed (Amaranthus retroflexus) and purslane (Portulace oleracea) where CMU was used. CIPC had severely stunted these same species. N-1 naphthyl phthalamic acid caused severe curling and the isopropyl ester of trichlorogenzoic acid resulted in considerable stunting of the weed present. TCA and dichloropropionic acid had little effect on these weed species. Weeds were removed by hand about one week after spraying and throughout the remainder of the season. N-1-naphthyl phthalamic acid caused severe curling of the onions and reduced the No. 1 yield by nearly 50%. None of the other treatments caused more than slight injury to the onion foliage and none of them caused a significant reduction in the yield. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana.)

Weed control in onions with CIPC. Warren, G. F. and Larsen, J. E. Several

replicated experiments were conducted during the past 3 years on Early Yellow Globe onions seeded from 1 to 2 inches deep on muck soil. Both pre-emergence and post-emergence treatments were applied using 8 and 12 lb of CIPC per A. The pre-emergence treatments were made 1 to 3 days before onion emergence and the post-emergence sprays were applied directly over the onions at various times after they reached the 2 to 3 leaf stage. In one experiment an application was also made when the onions were in the "knee" or "crook" stage.

Control of germinating or small emerged weeds of the following species was excellent; smart weed (Polygonum spp.) wild buckwheat (Polygonum convolvulus) and purslane (Portulaca oleracea). Control of lamb's quarters (Chenopodium album) and annual grasses was generally unsatisfactory while results on pigweed (Amaranthus retroflexus) were variable. Slight contact injury to the onion foliage was occasionally observed from post-emergence applications but recovery was rapid. This injury may have been caused by the xylene carrier in the formulations used. Stand and yield of onions on the plots has never been significantly lower than on the untreated checks and has averaged fully as high over the 3 year period. A single experiment with the Sweet Spanish variety gave similar results.

Pre-emergence treatments with a combination of CIPC and certain other herbicides gave better results, than did CIPC alone when resistant species such as lamb's quarters were present. Stoddard solvent at 50 to 75 gal/A, the amine salt of 2,4D at 1/2 lb/A and sodium isopropyl xanthate at 12 lb/A are among the herbicides which were satisfactory in supplementing the action of CIPC as a pre-emergence treatment. As a mid-season post-emergence application, CIPC appears to be especially valuable for purslane control. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana.)

Potatoes

Effect of MCP and 2,4D on potatoes. Dabbs, D. H. and Friesen, H. A. Irish cobbler potatoes were sprayed with MCP ester, amine and sodium salt at dosages of 0, 1/8, 1/4 and 1/2 lb/A and 2,4D amine at 1/4 lb/A during the 4 to 5 leaf stage of growth. A hand weeded check was also included. At the time of spraying the weed population consisted almost entirely of stinkweed seedlings.

The stinkweed appeared to be dying one week after the herbicides were applied. Two weeks later the stinkweed was dead on those plots treated with 2,4D amine and the 1/4 and 1/2 lb/A rates of each of the MCP formulations. The 1/8 lb/A dosage of each MCP formulation resulted in some stinkweed being killed and the surviving plants being severely stunted. Red-root pigweed and Russian thistle were stunted by the 2,4D and the heavy rates of MCP but not killed. Subsequent germination of these species lent a most unattractive appearance to the sprayed plots by late summer.

The potato leaves were slightly deformed by the MCP ester and amine at the 1/4 and 1/2 lb/A rate and by the 2,4D amine within one week after spraying. However, the subsequent growth appeared to be normal, except on the 2,4D amine plot. The potato yields on the plots sprayed with each of the MCP formulations at 1/2 lb/A and the 2,4D amine were equal in yield to the hand weeded check but significantly higher in yield than the unweeded check. The remaining MCP treatments were significantly lower in yield than the hand weeded check but were equal to or slightly higher in yield than the unweeded check. Tubers were generally smaller on those plots in which the weed control was poor. (Contributed by Dominion Experimental Station, Scott, Sask.) 1953.

Pre-emergence weed control in potatoes grown on muck soil. Nylund, R. E. Kennebec potatoes planted in muck soil on April 27, 1953, were sprayed with the following herbicides on May 19, at which time about 10% of the potatoes had emerged: N-1-naphthyl phthalamic acid at 8 lb and 12 lb, DNBP (alkanolamine salt) at 3/4 lb, 1 1/2 lb, and 3 lb, and CMU at 2 lb per acre. Precipitation during the 6 days following treatment was 0.63". Weed control, as determined by weed counts in each of the four replicates two weeks after herbicide application was 20, 46, 9, 20, 59, and 83% respectively, for the above 6 treatments. The poorer weed control with DNBP was primarily due to poor control of grass weeds which made up approximately 40% of the total weed population. Due to wet conditions later in the summer which resulted in excessive tuber rots, yields were not obtained. However, vine growth was apparently adversely affected only by the N-1-naphthyl phthalamic acid treatments. (Paper No. 3062 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.)

Pre-emergence treatments of Early Ohio potatoes with various herbicides for weed control. Pavlychenko, T. K. and Bestrop, A. J. One series of plots 12 X 15 ft in size were treated 3 to 4 days prior to emergence with 1 and 2 lb/A rates of ethyl ester of 2,4D (Weedone Concentrate), butoxy ethanol ester of 2,4D (Weedone LV4), emulsifiable acid of 2,4D (ACP 638), micronized acid of 2,4D (ACP 472), amine salt of MCP (Weeder MCP) and ester of MCP (ACP 904), and with 1 1/2 and 3 lb/A of 3-p-chlorophenyl-1-1-dimethylurea (CMU). A second series was similarily treated, but the ground was thoroughly raked immediately after spraying. The treated plots were left for 5 weeks undisturbed as if wet weather had prevented weeding them during that period. Two types of checks were provided: Checks A were also left undisturbed, and Checks B were hoed whenever weed growth warranted. The land was heavily infested with stinkweed (Thlaspe arvense) and Russian thistle (Salsola kali). RESULTS: At the end of 5 weeks in the first series, the weed kill was 83 pct. with 1 1/2 lb/A of CMU to 96 and 97 pct. with 1 lb/A of Weedone LV4 and Weedone Concentrate. The 2 lb/A rates, in all treatments, were not appreciably better in controlling weeds than the 1 lb/A rates. Significant increases in yield were obtained over the hoed checks B and much greater increases over the unhoed Checks A, with all treatments. In this regard the higher rates were much better than the lower rates (62 pct. with 1 1/2 lb/A of CMU to 134 pct. with 2 lb/A of ACP 904). In general, the 2,4D formulations tended to increase height, restrict branching and intensify the formation of chlorophyll as compared with the checks. In the second, raked series, weed kill was only slightly better, but yield increases were even more significant, ranging from 70 pct. with 1 1/2 lb/A of CMU to 139 pct. with 2 lb/A of Weedone LV4. (Contributed by Agr. Div. American Chemical Paint Co., Saskatoon, Sask.)

Sweet corn

Pre-emergence and post-emergence weed control in sweet corn. Hemphill, D. D. CMU, 1 pound per acre and Phenyldimethyl urea, 1 pound per acre were applied to four replicated randomized 25 foot plots of sweet corn, Golden Cross Bantam, one day after planting and SES, 4 pounds per acre and Premerge (alkanolamine salt of DNBP) 3 pounds per acre were applied to additional plots when the corn was 3 to 5 inches in height. Season was extremely dry and hot. Weeds were primarily crabgrass (Digitaria sanguinalis), foxtail (Setaria sps.) and yellow nut-grass (Cyperus esculentus).

Best weed control was given by Premerge since it was the most effective against grassy weeds. Applied at this stage SES did not give satisfactory weed control.

Premerge caused burning and stunting of the corn and reduced yields. No noticeable injury was evident in SES, CMU, or Phenyldimethyl urea plots. A reduction in yield in SES plots was probably due to weed competition rather than injury from SES. (Department of Horticulture, Missouri Agricultural Experiment Station, Columbia, Missouri. Journal Series No. 1388.)

crop was under water for about 3 days in early June. (Department of Horticulture, Agricultural Experiment Station, Madison, Wisconsin).

Pre-emergence weed control in onions. Warren, G. F. and Larsen, J. E. Early Yellow Globe onions were seeded about 1 1/2 inches deep in muck soil on April 7. On April 27, just prior to emergence, the following treatments were applied: CIPC, 8 lb; CMU, 2 and 4 lb; isopropyl ester of trichlorobenzoic acid (TCB), 8 lb. The treatments were replicated 4 times and were applied in water at 50 gal/A. At time of spraying the sky was clear, the temperature 49°F and the soil wet. Only light showers occurred during the next 2 weeks and totaled 1.23". All plots were hand weeded and cultivated throughout the season. Weed counts made May 28, and the stand and yield of onions are shown in the table below:

		No. weeds/sq ft			No. weeds/100 sq ft			No. 1 onion
Herbicide	lbs/A	Pigweed	Purslane	Grass	Smartweed	Lamb's Quarters	per ft of row	bu/A
Check		23.9	22.3	39.1	72.8	33.0	9.8	775
CIPC	8	23.8	4.4**	19.1	.0**	3.6**	9.8	754
CMU	2	10.8*	11.7**	25.6	155.0	6.3**	9.4	759
CMU	4	3.8**	3.4**	20.0	94.0	6.8**	8.5	681
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	L.S.D.	5%		N.S.			N.S.	98

* and ** significantly lower than the check at the 5% and 1% levels respectively.

In addition to the weed kill shown above, TCB cause severe stunting of the pigweed. There was no apparent injury to the onions except from 4 lb of CMU which caused noticeable stunting about 4 weeks after treatment. The results are similar to those obtained in other experiments except that lamb's quarters has usually not been killed by CIPC. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana.)

Tolerance of onions to herbicides applied as post-emergence sprays. Warren, G. F. and Larsen, J. E. Early Yellow Globe onions in the 2 to 3 leaf stage growing on muck soil were hand weeded about 1[illegible] days before the following treatments were applied on June 12: CIPC 8 lb/A; CMU, 3 lb; isopropyl ester of trichlorobenzoic acid, 8 lb; N-1 naphthyl phthalamic acid, 8 lb; TCA sodium salt, 4 lb acid equivalent alpha, alpha, dichloropropionic acid, amine salt, 1, 2, and 4 lb acid equivalent/A. All herbicides were applied in water at 50 gal/A and were directed so that only the lower 3 to 4 inches of the onion plants were hit by the spray. The first 3 herbicides listed were also applied over the top of the onions. Treatments were replicated 4 times. The temperature was 87°F, the sky clear and the soil surface dry when the treatments were applied. There was no rain during the next 11 days but 2.34 inches fell on the 12th day. Notes taken on weed control 5 days after spraying indicated good kill of pigweed (Amaranthus retroflexus) and purslane (Portulace oleracea) where CMU was used. CIPC had severely stunted these same species. N-1 naphthyl phthalamic acid caused severe curling and the isopropyl ester of trichlorobenzoic acid resulted in considerable stunting of the weed present. TCA and dichloropropionic acid had little effect on these weed species. Weeds were removed by hand about one week after spraying and throughout the remainder of the season. N-1 naphthyl phthalamic acid caused severe curling of the onions and reduced the No. 1 yield by nearly 50%. None of the other treatments caused more than slight injury to the onion foliage and none of them caused a significant reduction in the yield. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana.)

Weed control in onions with CIPC. Warren, G. F. and Larsen, J. E. Several

OTHER VEGETABLE CROPS

Summary

G. F. Warren

Beans: In pre-emergence experiments with snap and lima beans grown on mineral soils, DNBP, CIPC and N-1 naphthyl phthalamic acid gave good results in 2 out of 3 trials but caused some injury or poor weed control in the third. The sodium salt of PCP was satisfactory in the one experiment where it was tried but TCA and SES caused severe injury in one or more trials. On muck soil CMU reduced the weed stand 50% and did not injure snap beans; N-1 naphthyl phthalamic acid and xanthogen disulfide gave unsatisfactory weed control and endothal severely reduced the yield.

Cucurbits: Results with N-1 naphthyl phthalamic acid were variable, injury being reported in one abstract but not in the other. Squash showed greater injury than cucumbers, muskmelons and watermelons. Premerge causes somewhat more injury than N-1 naphthyl phthalamic acid.

Other crops: Abstracts are included on weed control in carrots, beets, spinach, peppermint, sweet potatoes and tobacco plant beds. Due to the diversity of the information contained in these they cannot be satisfactorily summarized and the reader is referred to the individual abstracts.

Abstracts

Chemical weed control in green beans. Hemphill, D. D. NPA, 6 pounds per acre, DNBP, amine salt, (Premerge) 4 pounds per acre, and CIPC, 10 pounds per acre were applied to four replicated randomized plots of green beans, Top Crop variety, one day after planting. SES, 4 pounds per acre, was applied to plots after beans were established. All chemicals gave satisfactory weed control. Premerge caused some injury and yields were reduced 30 per cent. SES caused severe burning of the leaves and yields were reduced 70 per cent. Yields of NPA were comparable to that of control plots while yields of CIPC plots were 30 per cent greater than controls. (Contribution of Department of Horticulture, Missouri Agricultural Experiment Station, Columbia, Missouri. Journal Series No. 1392)

Preemergence weed control in snap beans and lima beans. Lana, E. P. The following herbicides were applied at the indicated rates with 50 gallons of water per A. DNBP (alkanol amine) 6 and 12 lb. phenol equiv. TCA sodium salt, 4 and 8 lb. acid equiv.; CIPC, 4 and 8 lbs, Alanap-1, 4 and 8 lb.; Sesin 2 and 4 lb., and SES ethanol 2 and 4 lb. These materials were applied on May 15, the day after seeding. Weed stands were taken on June 17 about 3 weeks after emergence. The weed population of the untreated plots was composed of about 15% broad-leaved weeds and 85% annual grasses. DNBP at 12 lb. gave about 96% overall weed control. The broad-leaved weeds were controlled 100%. DNBP at 6 lb. also controlled the broad-leaved weeds 100% but the grasses were more numerous resulting in about 75% overall control. T.C.A. at 4 and 8 lb. showed a better control of grasses over broad-leaf control. Alanap-1 at 8 lb. gave an 80% control of weeds, the broad-leaved type being eliminated. CIPC 8 lb. gave about 85% overall control but both grasses and broad-leaved types were present. TCA at both rates showed severe stunting and chlorosis and no yields were obtained due to early plant mortality. CIPC at 8 lb. also showed chlorosis and stunting. Benzoate (Sesin) and ethanol forms of SES showed typical 2,4-D reaction on the lower leaves, but the later leaves were normal. There were no significant differences in yield except for SES ethanol 4 lb./A which reduced yields significantly.

The same materials and rates were utilized as preemergence treatments on lima beans. Weed control was similar to that in the snap bean study. TCA sodium salt 4 and 8 lb. produced chlorosis and early stunting, but later in the season the lima bean plants recovered and were blossoming late in the summer. There were no observable 2,4-D symptoms in the SES plots. No yields were obtained from these plots because of poor plant stands. (Iowa Agricultural Experiment Station, Ames, Iowa.)

Pre-emergence weed control in bush beans grown on muck soil. Nylund, R.E. Topcrop bush beans were seeded in muck soil on May 19 and three days later (three days before emergence) were sprayed with the following herbicides: 2 lb. CMU, 10 lb. xanthogen disulfide, 8 lb. endothal, 12 lb. N-1 naphthyl phthalamic acid, and 20 gal. E. H. 3. No weeds were emerged when treatments were applied. Although none of the treatments gave satisfactory weed control under these conditions, CMU controlled 50% of the weeds and endothal, 53%. The latter compound, however, reduced yields by 86% while none of the other herbicides measurably affected yields. (Paper No. 3063 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.)

Weed control in lima beans. Warren, G. F. Early Thorogreen lima beans were planted in a silt loam soil on June 15 and immediately afterward the following treatments were applied: DNBP, 10 lb./A; PCP sodium salt, 20 lb.; CIPC, 4 and 8 lb.; N-1 naphthyl phthalamic acid, 4 lb. All materials were applied in water at 100 gal./A and were replicated 6 times. At time of spraying, the soil surface was dry and the temperature 75°F. The lima beans emerged rapidly but no weeds germinated until after the first rain which occurred on June 25. Weeds were therefore less competitive than usual. In general, control of the weeds present, which consisted of both grasses and broadleaves, was approximately in the following order (best to poorest): DNBP, PCP, 8 lb. CIPC, N-1 naphthyl phthalamic acid and 4 lb. CIPC. All plots were cultivated one month after planting and again a week later. Two series of check plots were maintained, one in which the weeds were removed by hand from the rows, the other unweeded. None of the treated rows were weeded in the row. The treatments appeared to have no effect on growth or yield except as they influenced competition due to weeds. The average yield of the unweeded checks was 2565 lb. of shelled beans per A and of the hand weeded checks was 3887 lb. The treated plots yielded from 3059 to 3403 lb. The difference between the unweeded and any of the treated plots and the difference between these and the hand weeded plots was significant at the 1% level. There were no significant differences between the plots receiving herbicides. These results indicate that even a small number of weeds may reduce lima bean yields and that some hand hoeing should be practiced to obtain maximum yields even when a good herbicide treatment is used. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana,)

Chemical weed control in cucurbits. Hemphill, D. D. DNBP, amine salt (Premerge) - 4 pounds per acre, was applied to four replicated randomized plots of cantaloupes, Purdue 44, Iroquois and Hale's Best varieties; cucumbers, Chicago pickling variety; watermelons, Kleckley Sweet and New Hampshire Midget varieties; and squash, White Bush Scallop variety. N-1 naphthyl phthalamic acid (NPA) was applied to plots one day after planting at rate of 6 pounds per acre and was repeated four weeks later at rate of 3 pounds per acre. Season was extremely hot and dry.

Above treatments injured all plants and reduced yields. Premerge tended to cause more injury than NPA. Greatest amount of injury and reduction of yield exhibited by squash, while watermelons were injured least. Purdue 44 variety of cantaloupe appeared less tolerant to NPA than Iroquois and Hale's Best varieties.

A pre-emergence application of NPA, 4 pounds per acre, to a later planting causes visible injury and reduced yields in squash, slight stunting but no significant yield reduction in cantaloupes, no visible injury or reduction in yields in cucumbers and watermelons. (Department of Horticulture, Missouri Agriculture Experiment Station, Columbia, Missouri. Journal Series No. 1389.)

Weed control in cucurbits. Warren, G. F. A large number of replicated experiments have been conducted during the past 4 years with transplanted muskmelons and watermelons on a fine sand soil. Treatments were applied 1 to 8 days after transplanting. Control of crabgrass (Digitaria sanguinalis) and carpetweed (Mollugo verticillata) has been consistently good with 4 lb./A of N-1 napthyl phthalamic acid and an application of 2 lb. has given nearly as good results. Maturity yield and quality of the melons has never been significantly effected. A single experiment with field seeded National Pickling cucumbers on a silt loam soil indicated the need for higher rates of application on this soil type to control the above weed species. A rate of 4 lb./A appeared to be the minimum for practical control. In this experiment there was no delay in maturity and no reduction in stand or yield from either 4 or 8 lb. of N-1 napthyl phthalamic acid applied either as a pre-emergence or post-emergence treatment. N-1 naphthyl phthalimide was also used in several of the experiments. On the fine sand soil weed control was often as good with the "imide" as with the "acid" but under some conditions control was much poorer. In the cucumber experiment on the silt loam soil, the imide gave definitely poorer results than the acid. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana.)

The control of weeds in carrots with pre-emergence sprays. Fieldhouse, D. J. and L. G. Holm. Red-cored Chantenay carrots were planted in an organic soil in early June in a four replication randomized test. Pre-emergence treatments were made 4 days after planting. Rainfall amounting to .61 inches fell during the 2 weeks following planting. Pigweed (Amaranthus retroflexus), smartweed (Polygonum hydropiper), barnyard grass (Echinochloa crus-gali), crab-grass (Digitaria species), and water hemp (Acnida tuberculata) were the predominant weeds in the area. Stand counts of both carrots and weeds were made 4 weeks after planting and the plots were maintained free from weeds thereafter. The following chemicals were applied (all concentrations are in pounds per acre of acid equivalent or active ingredient of the appropriate compound): 3-CIPC (isopropyl-N- (3-chlorophenyl) carbamate) 8 and 12; CMU (3-p-chlorophenyl-1-1-eimethylurea) 1, 1½, and 2; TCA (sodium salt) 12, 16; PCP (sodium salt) 8, 12; Phenyldimethyurea 1½ and Weed Killer D (3-(3,4-dichlorophenyl)-1, 1, dimethylurea) 1½. All of the chemicals except CIPC at 8 pounds reduced the weed stand significantly. The CMU treatments reduced weed stands 60-86%, the PCP 50-75%, the CIPC 16 - 63%, the TCA 42 -66%, the Phenyldimethylurea 80%, and Weed Killer D 83%. Neither the stand nor the yield of carrots was reduced significantly by any of these treatments although the high rates of CMU, Weed Killer D, CIPC and PCP did bring about a 10% loss in stand. The latter two chemicals also reduced yields in the order of 10%. In addition, CMU at ½ and 1 pound was mixed with PCP 4, CIPC 4 and TCA 8 pounds. All of these mixtures reduced the weed stands by 90-95% with no reduction in yield of carrots. CMU at 1 pound in mixtures with the above three chemicals did bring about a 10% stand reduction of carrots. The use of phenyldimethylurea and its derivatives has shown considerable promise for pre-emergence weed control in carrots. It appears, however, that low rates of this compound mixed with low rates of CIPC, PCP, and TCA will provide much better weed control with no serious injury to the crop. It has been our observation that the employment of more than one chemical in a pre-emergence spray offers the opportunity for control of a greater number of weed species. (Department of Horticulture, University of Wisconsin, Agricultural Experiment Station, Madison, Wisconsin.)

Comparison of several methods of controlling weeds in tobacco plant beds. Freeman, J. F. Fall treatments of calcium cyanamide 1, 1.5, and 2 lb./ sq. yd.; fall and spring treatments with methyl bromide soil fumigant, 1 lb./100 sq. ft.; fall and spring drench treatments with allyl alcohol, 6 qt. in 200 gal. water/100 sq. yd.; fall and spring drench treatments with 51% Chlorobromopropene (CBP) Emulsible, 8 qt. in 200 gal. water/100 sq. yd.; spring treatment with heat from burning wood on the bed soil; and no treatment, were compared on quadruplicated plots on Maury silt loam soil at Lexington, Ky. A heavy bluegrass sod was plowed 6 weeks prior to fall treatments and the soil was thoroughly prepared ahead of fall and spring treatments. The fall treatments were made during warm weather of late September 1952 and the spring treatments during early April 1953.

Burley tobacco, Ky. 16 variety, was seeded uniformly over all plots April 14-12 days after the spring drench treatments were applied. Good stands of tobacco seedlings resulted on all treatments. The numbers of each species of weeds were determined in three 1 sq. ft. quadrats in each plot. The percentage control of the different treatments based on the total number of weeds on the untreated plots (83/sq. ft.) were: calcium cyanamide 1, 1.5, and 2 lb./sq. yd. - 69, 78 and 85% respectively; methyl bromide (fall) 94%; methyl bromide (spring) 94%; allyl alcohol (fall) 77%; allyl alcohol (spring) 77%; CBP Emul. (fall) 77%; CBP Emul. (spring) 86%; burned (spring) 96%. (Kentucky Agricultural Experiment Station.)

Selective chemical weed control in sweet potatoes, 1953. Hemphill, D. D. SES, 4 pounds per acre; Alanap-6 (N-1 naphthyl phthalamic acid and N-1 naphthyl phthalimide mixture), 4 pounds per acre; Dalapon (alpha, alpha-Dichloropropionic acid) 3 pounds per acre and 2,4-dichlorophenoxyethanol, 4 pounds per acre, were each applied to four replicated randomized 25 foot rows of sweet potatoes, variety B4570, five days after setting. The season was very dry and hot with temperatures above 100°F. not uncommon. Few weeds were present in any plot.

Alanap-6 caused leaf modification and Dalapon caused leaf burning. Injury to plants was reflected in reduced yields of 30 and 25 per cent respectively. SES and 2,4-dichlorophenoxyethanol causes no noticeable injury. Yields of these plots were comparable to hand weeded plots. Dalapon, SES and 2,4-dichlorophenoxyethanol were more effective against grasses while Alanap-6 was most effective against broad-leaved plants. (Department of Horticulture, Missouri Agricultural Experiment Station, Columbia, Missouri. Journal Series No. 1387.)

Weed control in peppermint. Larsen, J. E. and Warren, G. F. Peppermint roots were planted in muck soil April 9 and treated on April 14 before any shoots emerged with the following herbicides: 1) CMU, 6.4 lb./A; 2) PCP sodium salt, 24 lb. mixed with TCA sodium salt, 10 lb. acid equivalent; 3) PCP, 24 lb. with CIPC, 8 lb.; 4) PCP, 24 lb. with TCA, 10 lb. and CIPC, 8 lb.; 5) DNBP amine salt, 10 lb. mixed with TCA 10 lb.; 6) DNBP, 10 lb. with CIPC, 8 lb.; 7) DNBP, 10 lb. with TCA 10 lb. and CIPC, 8 lb. All materials were applied in water at 50 gal./A and were replicated 4 times. The temperature was 58°F, the sky clear and the soil surface dry when the treatments were applied. Rainfall during the next 2 weeks totaled 2.11 inches. Weeds in the check plots consisted almost entirely of broadleaves among which smartweed (Polygonum spp.) was most prevalent. Weed control early in the season was excellent wherever CIPC was included in the mixtures. When omitted, control was poor. CMU gave only partial control of the weeds. All plots were cultivated and hand weeded throughout the season. All mixtures containing TCA caused stunting of the mint early in the season and resulted in 10 to 15% reductions in oil yield which were significant at the 5% level. However, oil yield on these plots might have increased if harvest had been delayed. The other treatments had no

apparent effect on growth or yield. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana.)

Pre-emergence weed control in spinach, beets, and carrots grown on muck soil. Nylund, R. E. Bloomsdale Long Standing spinach, Detroit Dark Red beets, and Nantes carrots seeded on muck soil on April 23, 1953, were sprayed with various herbicides 12 days after seeding at which time the carrots and beets were sprouted but had not emerged and spinach was 5-10 percent emerged. Treatments applied (all in 100 gal. water per acre) to duplicate plots of each crop were: 2 lb. CMU, 10 lb. PCP, 8 lb. endothal, 12 lb. N-1-naphthyl phthalamic acid, 10 gal. E. H. 3, and 20 gal. E. H. 3. Precipitation during the six days following herbicide application was 1.46" all of which fell in one 24-hour period on the fifth day following treatment. Only CMU, 10 gal. E. H. 3, and 20 gal. E. H. 3 gave significant weed control, weed control being 70%, 74%, and 63%, respectively, for these treatments. All of the above treatments which were effective as weedicides, only slightly reduced yields of beets and carrots but seriously reduced yields of spinach. (Paper No. 3064 of the Scientific Journal Series of the Minnesota Agriculture Experiment Station.)

SMALL FRUITS AND ORNAMENTAL SHRUBS AND FLOWERS

Summary — L. G. Holm

Small Fruits. Reports were received from two stations on the control of weeds in grapes, raspberries, and strawberries. Weed control in grapes during a dry season was shown to be satisfactory with one application of CMU or phenyldimethyl urea. There was no injury to the grapes.

N-1 naphthyl phthalamic acid and SES (and related compounds) failed to control weeds in strawberries when no rain fell following the soil application. Repeat applications followed by rainfall provided effective weed control. The former chemical was injurious to the strawberries.

Soil applications of SES at 6 lbs/A for two seasons and 12 lbs/A in the third season effectively controlled weeds in raspberries without injury to the crop.

The use of the above chemicals in grapes and raspberries appears very promising. Additional work would be desirable at other stations to determine the general effectiveness of these treatments for the North Central region.

Ornamental Shrubs and Flowers. The work in progress at two stations indicates that herbicides may be used to advantage for the control of weeds in shrubs grown on both cultivated and uncultivated areas. In an effort to control weeds throughout the season, 2,4,5-trichlorophenoxyethyl sulfate, SES and N-1 naphthyl phthalamic acid were applied to the same plots of coniferous and deciduous shrubs in April, June and July. The later treatments gave highly effective weed control without crop injury. The treatment with SES in April when the soil was cold did not produce worthwhile results. In other experiments, one year old grafts and rooted cuttings of the Juniper species exhibited a remarkable tolerance for SES and 2,4,5-trichlorophenoxyethyl sulfate.

Multiflora rose, coralberry and wild grape showed considerable tolerance to CMU in a test on a newly-burned, undisturbed quackgrass-bluegrass sod. Many of the shrubs made excellent growth during two seasons in areas where weed competition was reduced by chemical treatment only.

Abstracts

Small Fruits

Weed control with SES in red raspberries. Denisen, E. L. SES has been used during 3 successive seasons in the same planting of Latham raspberries on a heavy loam soil. The first year's applications of 2, 4 and 6 lbs/A of SES were made to the new planting on July 6, 1951. Very effective control of broadleafed weeds and annual grasses was obtained at the 4 and 6 lb rates and no deleterious effect was noted on either the parent or sucker plants. Yields the following summer showed no significant differences between the treated plots and the hand weeded check. The same rates of SES were applied to the respective plots twice during the summer of 1952 with results similar to the first year. Yields in the summer of 1953 again showed no significant differences between the herbicide treatments and the hand weeded check. On April 4 of 1953 the rate of each treatment was doubled so that 4, 8 and 12 lbs/A of SES were applied. At these higher rates no injury was observed to the old plants or new sucker plants. By the third year very dense hedge rows had developed from the original planting and all plots

showed very little infestation of weeds. Herbicide applications during the course of the experiment were made in the row. The area between rows was cultivated in order to control the spread of the raspberries by removing the suckers. A fall cover crop of oats was planted each year to harden the canes for winter. The spring and summer applications of SES did not interfere with germination of the fall cover crop. (Department of Horticulture, Iowa State College, Ames, Iowa.)

Chemical weed control in strawberries. Denisen, E. L. The following amounts of herbicides were applied to four replications of spring planted Dunlap strawberries on July 9: SES, 4 lbs/A; SESIN (benzoate form of SES), 6 lbs/A; SESIN, 10 lbs/A; Alanap 1 (n-1 naphthyl phthalamic acid), 6 lbs/A. All plots including the unsprayed check were hand weeded prior to the spray applications. The soil surface was dry at the time of application and no rain fell during the following two weeks. None of the herbicides were effective in controlling weeds under these dry conditions. All plots were again cultivated and repeat applications of the herbicide treatments were made on July 27. Light rains followed this application and very effective weed control was obtained in all the treated plots. Some leaf injury was noted in the Alanap 1 treatments. Counts of rooted runners on October 1 failed to show any significant differences between the various herbicides and the check. Drouth conditions during much of the growing season made it difficult for runners to root into the dry soil. A fall application of the herbicides is contemplated. Yields of the various plots will be taken in the spring of 1954. (Department of Horticulture, Iowa State College, Ames, Iowa.)

The influence of chemical weed control in strawberries on moisture content of the soil under drouth conditions. Denisen, E. L. In an herbicide experiment in strawberries in which very effective weed control was obtained with 4 lbs/A of SES, applied on July 27, it was noted in mid-October that numerous plants in each check plot were wilted and dying. Composite samples of soil from four locations were taken at three inch depths on October 19 in each of the SES and check plots in the four replications and oven dried at 104° C. Highly significant differences in soil moisture percentage were found between the SES and check plots. The mean moisture percentage of the soil in the check was 8.3 and in SES plots was 10.8. The difference in moisture content is attributed to the dense growth of weeds (principally purslane and annual grasses) in the check and increased evaporation from the disturbed soil following weeding on August 28. The soil surface of the SES plots was almost entirely weed free and was not disturbed. For the period of August 1 to October 19, the total rainfall was approximately 7 inches below normal. (Department of Horticulture, Iowa State College, Ames, Iowa.)

Chemical weed control in grapes. Hemphill, D. D. Four chemicals were tested for weed control effectiveness and phytotoxicity in a Concord grape vineyard. CMU - 2 pounds per acre, Phenyldimethyl urea - 2 pounds per acre, Endothal - 8 pounds per acre, and DNBP fortified diesel fuel spray (2 quarts Dow General + 20 gallons diesel fuel in 100 gallons of spray) were applied to four replicated randomized 50 foot plots in early May. Chemical sprays were applied in 2 foot bands beneath trellis. Application of Oil-DNBP and Endothal was repeated after six weeks. Season was dry and hot.

One application of CMU or Phenyldimethyl urea gave satisfactory control throughout the season and gave better weed control than two applications of Endothal or Oil-DNBP.

No reduction in yield or plant injury was noted for any treatment. It must be emphasized, however, that this experiment was carried out under conditions of

below-normal rainfall for this area. (Department of Horticulture, Missouri Agricultural Experiment Station, Columbia, Missouri. Journal Series No. 1390.)

Ornamental Shrubs and Flowers

Use of herbicides in establishing shrubs. **Hamilton, K. C. and Buchholtz, K. P.** On April 18, 1952, the accumulated litter was burned on an undisturbed quackgrass-bluegrass sod. On April 24 CMU, CIPC and Endothal were applied at 10, 20 and 40 lbs/A and TCA at 20, 40 and 80 lbs/A to plots 10 by 13 feet. Once cultivated and uncultivated checks were included and all treatments were replicated four times. Six transplants each of rose (Rosa multiflora), highbush cranberry (Vibrunum trilobium) and wild grape (Vitus sp.) were planted on each plot on May 8 by use of a planting bar. Three transplants of coralberry (Symphoricarpos orbiculatus) were planted in all plots in two replicates. The table shows the average height of the rose and coralberry plants at the end of 1952 and 1953 growing seasons, the percent survival of original planting, and the average number of shoots per surviving plant in the fall of 1953.

Treatment lbs/A		Rose				Coralberry			
		Plant ht. inches		Pct. alive	Shoot no.	Plant ht. inches		Pct. alive	Shoot no.
		1952	1953	1953	1953	1952	1953	1953	1953
CMU	10	17	33	67	2.6	21	26	100	2.3
	20	16	33	54	2.5	30	34	100	8.2
	40	18	58	29	3.6	15	34	100	8.2
TCA	20	13	16	67	1.4	16	19	100	1.7
	40	13	18	75	1.3	19	17	100	1.7
	80	10	17	46	1.5	13	16	100	1.3
CIPC	10	13	17	83	1.1	13	17	100	1.2
	20	15	20	50	1.5	11	14	100	1.8
	40	13	19	79	1.4	12	23	83	1.6
Endothal	10	17	24	87	1.5	20	22	100	1.2
	20	13	19	75	1.3	20	18	100	1.3
	40	14	25	83	1.5	17	21	83	1.5
Ck-cult.		20	28	87	2.0	16	24	100	3.0
Ck-uncult.		15	19	87	1.5	22	24	100	1.7

At the end of the first growing season the roses on various plots did not vary greatly in height. At the end of the second growing season, although the stand of roses had been reduced on plots treated with CMU, the surviving plants were much taller and had more primary shoots per plant than the plants on plots receiving other treatments. The roses on plots treated with CMU had many large secondary shoots developing well up on the primary stem, while plants on other plots developed few shoots. During the first season coralberry made the greatest growth on plots treated with 20 lbs of CMU. At the end of the second summer these plants showed little additional increase in height but by rooting at the nodes of arching branches they had spread laterally up to five feet. Coralberry plants treated with CMU at 40 lbs/A made rapid growth during the second season and averaged 8.2 shoots per plant in the fall while plants on the other plots averaged no more than 3.0 shoots. Increased growth of these two shrubs on treated plots appeared to be due to reduced competition from the original sod and annual weeds.

The survival of grape on the plots treated with 20 and 40 lbs/A of CMU was 44% and 22%, compared to that of the checks. However, the plants surviving the

first season made 170% and 290% greater growth than those on the check plots by the end of the second growing season. All chemical treatments reduced the stands of highbush cranberry. There was no apparent difference in the average height of the surviving plants for any of the treatments. (Department of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Chemical weed control in established nursery stock. III. Mahlstede, J. P. Eight replications (1,200 square feet per replication), projected on a Webster type soil, containing Juniperus procumbens (6th year), Juniperus chinensis vars. (8th year), Picea pungens (4th year), Syringa spp., Philadelphus spp. and Paeonia spp. (4th year) were treated with three chemicals in the spring and summer of 1953. Each treatment was applied with a low pressure sprayer, utilizing a covered boom to minimize drift. SES at the rate of 6 and 12 lbs/A, and Alanap 1 (N-1 naphthyl phthalamic acid) at the rate of 5 lbs/A were applied to weed free plots on April 24, June 18, and July 31. The plots had been previously top dressed with soil containing a high weed seed population. Weed control effectiveness was based on averages derived from weed counts, visual evaluation of vigor, and weed weight. At intervals of 50, 40, and 50 days, respectively, following the above 3 application dates, SES (6 lbs/A) resulted in 36, 84, and 80 percent control of all broad and narrow leaf weeds with the progress of the season. The 12 lbs/A application of SES resulted in 18, 90, and 83 percent control. Alanap 1, (5 lbs/A) gave 85 percent weed control to June 13th, as contrasted to 54 and 83 percent control recorded on July 28, and September 19. Application of Natrin (6 lbs/A) on June 18 and July 31 resulted in 77 and 88 percent control, respectively. A combination spray, utilizing Alanap 1 (5 lbs/A) and SES (5 lbs/A), applied July 31 gave 90 percent weed control in data recorded September 19. The April application of Alanap 1 reduced hand labor by one-third, and the July 31 application of Alanap-SES reduced hoeing operations by 85 percent as compared to the check plots. Fall observations indicated tolerance of all treated plant material to soil applications of the chemicals utilized in these trials. (Department of Horticulture, Iowa State College, Ames, Iowa.)

Studies on weed control in conifer transplant beds. III. Mahlstede, J. P. One-year-old grafts of Juniperus chinensis Maney were transplanted under lath, from pots, April 20, 1953. Sixteen plots, each containing 32 grafts were treated with SES at the rates of 4, 8 , and 12 lbs/A on June 3 and July 23. The entire experiment was hand weeded prior to each spray application, and top dressed with a sand soil mixture which was artificially inoculated with weed seeds. Although weed control effectiveness was based on weed counts, visual observations of the vigor of weed population per plot, and weed weight, no control above that of 50 percent was obtained with either the 4, 8, or 12 lbs/A rates of SES as evaluated on July 22 and October 1. Near drought conditions was the principle factor contributing to the lack of differentiation between weed control in treated and non-treated plots. (Department of Horticulture, Iowa Agricultural Experiment Station, Ames, Iowa.)

Further studies on weed control in conifer transplant beds. IV. Mahlstede, J. P. Rooted cuttings of Juniperus chinensis pfitzeriana, transplanted in beds in April of 1953 were sprayed with Natrin (4 and 8 lbs/A), and the benzoate, ethanol (8 lbs/A), and liquid benzoate (10 lbs/A) forms of SES on June 3 and July 23. The entire experiment, which consisted of three replications with 30 seedlings per plot was hand weeded, top dressed with a sand-soil mixture containing a high weed seed population, and thoroughly watered prior to each herbicide application. Control of broad and narrow leaf weeds increased from an average of 32 percent on July 22 and October 1, for the four lbs/A rate of Natrin, to an average of 93 percent for the eight lbs/A rate. Plots treated with CMU resulted in 85 percent control, at the termination of each trial period of such weeds as peppergrass, shepherd's purse,

and purslane, which were the principle weeds in the check plots. The remaining chemicals at the rates specified resulted in weed control percentages below those considered economical. No apparent injury or growth inhibition was evident at the end of the growing season as a result of the application of these herbicides. (Department of Horticulture, Iowa Agricultural Experiment Station, Ames, Iowa.)

TURF WEEDS

B. H. Grigsby

Summary

Five abstracts concerning the use of chemicals on turf were received. Two abstracts dealt with MH as a grass retardant and the remainder with various broad-leaved turf weeds.

Anderson, Walter and Mitchell were unable to draw any conclusions with respect to reduction of required mowings following MH treatments.

Grigsby found that MCP was effective on common chickweed whereas 2,4-D failed to control this weed. He also found that Veronica officinalis was resistant to both 2,4-D and MCP, but was readily controlled by spraying with endothal.

Abstracts of Results of Cooperators

EFFECT of MH as a growth retardant on maintained lawns. Anderson, C. J., Walter, C. and Mitchell, W. C. MH was applied on May 25, 1953, to lawn plots containing Kentucky bluegrass at rate of 3, 4, 5, and 10 lb/A, replicated 5 times each with check plots. One replication was unmowed; one was mowed once, and remaining three replications mowed three times. Average temperature for period May thru September was normal while average precipitation was 2.16 in. compared to normal average of 4.02 in. per month. One month after application the grass on unmowed plots treated with 10 lb/A of MH had almost 25% less seed heads than check plots. Slight retardation of growth was observed on the mowed plots at the 10 lb. rate but as season progressed this difference disappeared. On September 18th, seed heads on the unmowed check plot were considerably more numerous but averaged only 9 in. high compared to an average of 15 in. high on treated unmowed plots. Only the plot treated with 10 lbs. MH had noticeably fewer seed heads than the check plots. The difference in seed heads was the only observable difference in all plots. No differences in the mowed plots were observed. MH delayed the formation of seed heads on bluegrass, but because of dry weather no conclusions can be made that number of mowings was reduced. (Iowa Ordnance Plant - Silas Mason Co. in cooperation with Geigy Chemical Corporation, Burlington, Iowa.)

EFFECT of MH as a growth retardant on roadside vegetation. Anderson, C. J., Walter, C. and Mitchell, W. C. MH was sprayed May 25, 1953, on roadside strips containing Kentucky bluegrass and few annual weeds at rates of 5, 10 and 15 lb/A. No replications were made but check strips were between each treated strip. A square rod at the end of each strip was left unmowed until September. Remainder of strips were mowed three times. Average temperature for period May thru September was normal while average precipitation was 2.16 inches compared to normal of 4.02 inches per month. Two weeks after application differences in growth were observed; grass and weeds in 15 lb. strips were 3 to 4 inches shorter than grass and weeds in check plots. Growth in 5 and 10 lb. strips was reduced only slightly when compared with check plots. After mowing, only slight differences in regrowth were observed. Only the 15 lbs. rate showed any significant degree of retardation and this difference eventually disappeared with dry summer weather. Consequently, no conclusions can be drawn that MH reduced the number of required mowings. (Iowa Ordnance Plant - Silas Mason Company in cooperation with Geigy Chemical Corporation, Burlington, Iowa.)

REMOVAL of mature crabgrass prior to fall re-seeding of turf. Grigsby, B. H. Turf plots in which crabgrass control was not obtained with various herbicides were put into condition for re-seeding by two applications of stoddard solvent. 40 gallons of the oil were used at each spraying, 7 days apart, and a complete kill of the crabgrass obtained. This procedure, in the first week of September, did not cause any injury to Kentucky bluegrass and chewing's fescue. Bent grass in the old turf was severely burned but made a rapid recovery. Grass seed were planted 5 days after the last spraying and a good stand obtained. (Contrib. from Mich. Agric. Exp. Sta. and Div. Weed Invest. BPIS & AE)

EFFECTS of certain herbicides on common chickweed and ground ivy. Grigsby, B. H. Turf plots containing common chickweed and ground ivy were sprayed in July and August, 1953, with an ester and an amine formulation of 2,4-D, 2,4,5-T, MCP and endothal. Endothal was applied at rates of 2 and 4 lbs. per acre and all other compounds at 1 and 2 lbs. per acre. Excellent control of chickweed and ground ivy obtained with 2 lbs. MCP without injury to turf grasses. None of the other chemicals caused more than a partial defoliation of chickweed. The 2 pound rate of 2,4-D ester was effective on ground ivy. (Contrib. from Mich. Agric. Exp. Sta. and Div. Weed Invest. BPIS & AE)

CONTROL of speedwell (Veronica officinalis) by chemical sprays. Grigsby, B. H. A turf consisting of a mixture of Kentucky bluegrass, fescue and bent grasses, in which a heavy infestation of speedwell was present, was sprayed in August, 1953, as follows:

2,4-D	ester	1 and 2 lbs. per acre
MCP	ester	1 and 2 lbs. per acre
2,4,5-T	ester	1 and 2 lbs. per acre
Endothal	ester	2 and 4 lbs. per acre

Endothal, at the 2 lb. rate gave a 75% control and 100% kill at the 4 lbs. rate. The lower rate did not damage turf grasses but the 4 lbs. rate caused a temporary stunting. Recovery was apparent 4 weeks after spraying. Round leaf plantain was also killed by the heavier application of endothal. None of the other chemicals killed speedwell. (Contrib. from Mich. Agric. Exp. Sta. and Div. Weed Invest. BPIS & AE)

DEFOLIANTS AND PRE-HARVEST WEED CONTROL

W. M. Phillips

Summary

Small-seeded legumes. Three workers submitted five reports on the effect of chemicals on alfalfa and sweet clover. DNBP, PCP, endothal, sodium cyanamid, sodium monochloroacetate, a chlorate-borate mixture, and an aromatic oil were used in these tests. Temperature and other weather conditions appear to be important factors in determining results. One report indicated that, when applied at cool temperatures, endothal was slightly superior to DNBP, but that neither chemical was effective in drying stems and pods of alfalfa. Results from other locations showed that DNBP and PCP reduced moisture more than any of the other chemicals. In most cases, where it was possible to make direct comparisons, it appeared that the effectiveness of PCP and DNBP was increased with an increase in the volume of carrier per acre. One worker compared spraying and combining with conventional methods of harvesting alfalfa seed and reported a 10% increase in seed yield from the combined plots. Larger increases were obtained from a similar experiment with sweet clover.

Sorghum. Endothal, sodium monochloroacetate, an aromatic oil, DNBP and PCP were applied to sorghum. One worker reported little or no reduction in the moisture content of the sorghum grain. Results from another location showed PCP to be highly effective while DNBP and sodium monochloroacetate caused some drying of the grain.

Wheat. Sodium cyanimid, endothal, and dalapon had no effect on the loss of moisture from wheat with 23% moisture at the time of treatment. Wheat yields were reduced when the wheat was treated when the grain had 46% moisture.

Flax. Endothal was more effective than DNAP in drying pigeon grass in flax. Neither of these chemicals, as well as several others, reduced the moisture content of flax sufficiently to store if combined one week after spraying.

Abstracts of Results of Cooperators

A comparison of pre-harvest sprays for top-killing alfalfa. Corns, W. G. During the past few years several chemicals have been tested in this project to compare their effectiveness in drying the vegetation of standing legumes in preparation for combine harvesting the seed. This year Endothal was included for the first time. Chemicals and rates were:

Endothal: (Penn Salt Co. S.4069 desiccant) 1 and 2 gal. with activator in 30 gal. water/A.

Sodium Cyanamid: (N.A. Cyanamid Co. new formulation of X5) 19 and 30 gal. water with 0.1% detergent/A.

Aromatic Oil: (Imperial Oil Co. product QXW 302A) 12 and 20 gal. made up to 30 gal. per acre with water and 0.1% detergent.

Dinitro Compound: (Dow General) 1½ and 3 pints with 10 gal. Diesel oil, water and detergent to total 30 gal/A.

Costs were estimated to be $5 and $8 per acre for the low and high rates of the various treatments. Alfalfa was about 30" tall at spraying time on September 2. Temperatures at, and following time of treatments, were 40 - 60° F, too low for best results. Within five days the treatments with Endothal and Dinitro dried up 70 - 85% of the leaves on the upper two-thirds of the plants. Endothal was slightly superior to Dinitro in these tests, but stems remained green and pods and seeds showed no appreciable superiority in dryness over check material until about twelve days after treatment. At this time there was considerable regrowth apparent. The other chemicals caused only 15-20% killing of vegetation and were much less satisfactory than they had been in most tests in previous years. Sodium Cyanamid was the least effective of the chemicals

tested this year. Formulation difference may have been responsible.

In general, the costs of treatment, and their occasional unreliability chiefly attributable to low fall temperatures in northern areas, are the main factors requiring assessment in full scale field demonstrations in the various seed producing areas. (Contribution from Department of Plant Science, University of Alberta, Edmonton.)

Chemical desiccation of sorghum. Phillips, W. M. Plots of Midland, a combine type grain sorghum, were treated with a chemical desiccant on two different dates in an attempt to reduce the moisture content of the grain and thus advance the date of harvest. An application of 4 pounds PCP in 20 gallons of diesel fuel per acre made when the grain was carrying approximately 40% moisture failed to appreciably reduce the moisture content of the grain two weeks after application. The treatment was effective only in drying the upper-most leaves of the plant. Death of the upper leaves resulted in gradual dying of the peduncle and ultimately resulted in some shriveling of the grain, but moisture in the grain was not reduced significantly below that in untreated plots. Applications of 4 pounds PCP in 20 gallons of diesel fuel per acre, 1.25 pounds DNBP in 20 gallos diesel fuel per acre, and 1 gallong Endothal Desiccant in 20 gallons of water per acre were made at a time when the sorghum grain had approximately 18 percent moisture. These treatments also failed to reduce the moisture content of the grain. The dinitro and PCP formulations were effective in drying the leaves, but did not affect appreciably the peduncle or head. Endothal was not effective at the rates used. It should be recognized that sorghum grain is almost entirely exposed and applications of chemicals may result in residues remaining on the grain. (Contribution from Division of Weed Investigations, BPISAE, USDA, and Kansas Agricultural Experiment Station, Fort Hays Branch, Hays, Kansas.)

The use of chemicals for desiccating alfalfa and weeds. Phillips, W. M. A series of one acre alfalfa plots were sprayed August 25 by airplane with DNBP, PCP, and Endothal Desiccant. The DNBP was applied at 0.62, 1.25, 1.87 pounds in 6 gallons of diesel fuel per acre and 1.25 pounds in 3 and 9 gallons of diesel fuel per acre. PCP was applied at 2 and 4 pounds in 6 gallons of disel fuel and the Endothal Desiccant at one gallon (4 lbs.) in 5 gallons of water per acre. The field was heavily infested with Kochia and other annual weeds. Samples were taken before spraying to determine moisture content of both alfalfa and weeds. Additional samples were taken 52 hours after application. At that time 1.87 pounds of DNBP in 6 gallons of oil per acre had reduced the moisture content of the alfalfa to a greater extent than other treatments. The 1.25 pounds of DNBP in 9 gallons of oil was most effective in reducing the moisture content of the weeds. The 3 gallon volume of 1.25 pounds of DNBP gave less drying than other DNBP treatments. Neither the PCP nor Endothal were as effective as the DNBP treatments. None of the treatments, including the most effective DNBP application, was entirely satisfactory from the standpoint of desiccating crop and weeds sufficiently to allow combining of the alfalfa seed. A second application of 1.25 pounds DNBP in 6 gallons of diesel fuel per acre over the entire plot area was necessary before the seed could be combined. Following the original applications maximum temperatures for the succeeding three days were 94° or higher. The humidity was relatively low and wind velocities high at the time of application and during the entire drying period. (Contribution from Division of Weed Investigations, BPISAE, USDA, and Kansas Agricultural Experiment Station, Fort Hays Branch, Hays, Kansas.)

The effect of pre-harvest spraying on the seed yield of Buffalo alfalfa

Phillips, W. M. and Franklin, W. W. A 45-acre field of Buffalo alfalfa was sprayed September 15 with 1.25 pounds of DNBP in 8 gallons of diesel fuel per acre by airplane. Before spraying, six pairs of plots were laid out in the field and one plot of each pair was mowed and the hay windrowed. The mowed plots were later picked up with the same combine used to harvest the standing alfalfa. Alfalfa on the plots which were sprayed was combined 56 hours after application of chemicals. The windrowed plots were threshed 72 hours after cutting. At the time of threshing seed from plots which were sprayed and combined was slightly higher in moisture than the seed from the windrowed plots. In all six pairs the combining resulted in a higher seed yield than was obtained from the windrowed plots. The average yield of the combined plots was 465.7 pounds per acre and the average yield from the mowed, windrowed, and picked-up plots was 421.8 pounds per acre. This gives an average difference of 43.9 pounds per acre or 10.4% increased over mowing. (t test: t = 5.97**) The range of differences between the pairs varied from 22.9 to 71.6 pounds per acre. In a similar experiment conducted in 1952 the average of the mowed and windrowed plots was 339.3 pounds per acre and the average of the sprayed and combined plots was 377.1 pounds per acre or an average difference of 37.8 pounds in favor of combining. All yields were on a basis of clean, dry alfalfa seed. (Contribution from Division of Weed Investigations, BPISAE, USDA, and Kansas Agricultural Experiment Station, Fort Hays Branch, Hays, Kansas.)

Pre-harvest spraying of B5128 flax at maturity. Robinson, R. G. and Dunham, R. S. Various formulations, rates, and carriers were rated for their drying effects on weeds and flax stems. Square rod plots at Rosemount, Minnesota were sprayed when the flax was mature (August 10) but stems were still green. A uniform pressure of 30 lbs., a uniform volume of 20 gal., and a uniform spreader-sticker were used for each formulation.

Ratings were made a week after spraying by visual observation. Endothal S-4069 (Pennsalt) at 2 gal. (1.26 lb. endothal + 6.3 lb. amm. sulfate) per acre resulted in dry pigeon grass, smartweed, and flax stems. It was equally effective in 20 gal. of water per acre or in 10 gal. of diesel oil plus 10 gal. of water. DNAP and Herbicide 410 Conc. (Assoc. Sales & Supply Co.) were somewhat less effective on pigeon grass than endothal. DNAP at 1.87 lb. in 5 gal. of diesel oil plus 15 gal. of water was used and 4 qts. (4 lb. PCP) of H 410 in 10 gal. of diesel oil plus 10 gal. of water. Sodium chloroacetate at 6.8 lb., Shed-A-Leaf powder at 10 lb., Shed-A-Leaf liquid at 3 gal., and Aero Sodium Cyanamid, soluble X-5, at 30 lb. were each applied in 20 gal. of water and were least effective. No treatment resulted in seeds dry enough to store if combined one week after spraying. (Contribution from the Department of Agronomy & Plant Genetics, University of Minnesota; St. Paul, Minn. Paper No. 3071 Sci. Jour. Series, Minn. Agric. Exp. Station.)

Chemical drying of alfalfa for seed production. Shafter, N. E. Triplicate plots were treated using a knapsack sprayer and 4 nozzle boom. Application rate was calibrated for uniform coverage at 10 gal/A. Most of the alfalfa pods were brown at the time of spraying. Endothal and sodium monochloroacetate were applied September 5. At time of application there was a heavy dew, temperature was cool (min. 51° - max. 82°) and the wind was calm. Soil was moist from 1.2 ins. of rain on September 3. Pentachlorophenol and dinitro phenol were applied September 9. Weather was warm (min. 62° - max. 89°), wind 5 mph northwest and no dew. Harvesting was done September 11 of all plots except the mowed check which was mowed and windrowed September 11 and combined September 14. Moisture samples were taken from the combine and percentages determined using 100 gm. samples in an electric oven at 104° - 110° C. Treatments and moisture percentages were as follows:

1. 2 pt. dinitro-o-secondary butyl phenol up to 10 gal. oil/A. 9.25%
2. 1 gal. pentachlorophenol up to 10 gal oil/A. 10.26%
3. 1 gal. endothal up to 10 gal. water/A 13.63%
4. 8 lb. sodium monochloroacetate in 10 gal. water/A. 11.60%
5. Mow, windrow and combine 3 days later 8.46%

Under favorable conditions a moisture content of 12% in uncleaned seed would usually be safe. A moisture content of 10% would be safe under almost all conditions. Endothal and sodium monochloroacetate gave very good drying of the alfalfa plants but were not as effective on weed growth as the other treatments. (Contribution from Department of Agronomy, University of Nebraska, Lincoln, Nebraska.)

Chemical drying of grain sorghum. Shafer, N. E. Triplicate 2 acre plots of Martin milo were sprayed with a high clearance ground sprayer and with an airplane. Treatments were made September 19 following a period of two weeks with no rainfall. Temperatures were cool for the week following application (min. 50° - max. 75°) with clear skies and no rainfall. Harvesting was done with a combine on September 27 and 28, several weeks ahead of first frost. Moisture samples were taken from the combine at harvest time and moisture determinations were made using an electric oven at 104-110° C. The following treatments were applied by airplane at a total volume of 6.6 gal. per acre:

1. 5 qt. pentachlorophenol in No. 2 diesel fuel. 11.5%
2. 2.6 pt. dinitro-o-secondary butyl phenol in diesel fuel 14.9%
3. 10.4 lb. sodium mono-chloroacetate in water 13.6%

By ground sprayer:

4. 1 gal. pentachlorophenol in 3 gal. diesel fuel + 3 gal. water/A. . .11.7%

Direct combined with no chemical treatment. 18.5%

Hydrin, a high aromatic petroleum hydrocarbon provided by Carbide and Carbon Chemicals, was not effective at 5 gal. per acre undiluted or at 10 gal. per acre diluted half with water. The remainder of the field was sprayed with the ground sprayer. All of the grain was being stored in farm storage at an average of about 12% moisture without further drying being necessary. (Contribution from Department of Agronomy, University of Nebraska, Lincoln, Nebraska.)

Chemical drying of sweetclover as an aid in seed harvest. Shafer, N. E. Three acre plots of Madrid sweetclover were sprayed by airplane when approximately one-half of the seed pods had turned brown. Endothal and a liquid chlorate-borate mixture were applied July 10 at a rate of one gal. of product plus 4 gal. of water per acre. The weather at time of spraying was cool (58° min. - 87° max.) with no wind and a heavy dew. Pentachlorophenol and dinitrophenol were applied July 13 at two separate concentrations in two different volumes of diesel oil carrier. Weather was somewhat warmer (66° min. - 89° max.) with a moderate dew, and almost no wind. Combine harvesting was started 3 days later (July 16) and completed July 17. Moisture determinations were made on the seed from each plot as it came from the combine using 100 gm. samples in an electric oven at 104-110° C. Treatments and moisture percentages were as follows:

1. Direct combining unsprayed sweetclover. 18.5%
2. 1 gal. chlorate-borate (Shed-A-Leaf) up to 5 gal. water/A 16.0%
3. 1 qt. (1 lb.) pentachlorophenol up to 10 gal. oil/A 10.7%
4. 1 pt. dinitro-ortho-secondary butyl phenol up to 10 gal. oil/A. . 10.0%
5. 2 qt. (2 lb.) pentachlorophenol up to 5 gal. oil/A. 12.3%
6. 2 pt. dinitro-ortho-secondary butyl phenol up to 5 gal. oil/A. . 12.0%
7. 1 gal. endothal up to 5 gal. water/A. 13.0%
8. Mow, windrow, and then combine. 10.7%

Under average conditions a moisture percentage of 12 is generally safe for storage while a moisture of 10% would be safe under almost all storage conditions. Germination tests have shown no effect either on percentage germination or on number of hard seeds. (Contribution from Department of Agronomy, University of Nebraska, Lincoln, Nebraska.)

Application of desiccants on the sweetclover seed crop. Zahnley, J. W. Endothal and DNOSBP were applied to mature sweetclover both by airplane and ground equipment to hasten drying and facilitate combining the standing crop. Airplane applications were made at rates of 3 pt. DNOSBP in 3, 6, and 9 gal. diesel fuel and 1 gal. Endothal in 6 gal. of water per acre. An untreated area was mowed with windrower attachment on the mower and a similar area was left for combining the standing untreated crop. Spraying and mowing were done on July 2. An inch of rain fell on July 3 and the windrows were later turned by hand. The dinitro plots were ready to combine July 4 but combining was delayed until July 6. The Endothal treated plots and the unsprayed areas were combined July 7. The area treated with Endothal dried much more slowly than the dinitro treated plots but was a little drier than the untreated check. Yields of seed in pounds per acre were: windrowed 110, untreated standing 147, Endothal 165, average of dinitro treatments 197. These data show a gain of 87 lb. of seed per acre by use of dinitro over no treatment and windrowed, 50 lb. over the untreated standing crop, and 32 lb. over the Endothal. There was no significant difference in yield from the dinitro treated plots due to different volumes of carrier used. Similar treatments were made in another field by use of a small narrow tread tractor equipped with a 40 ft. boom. Results were comparable with airplane treatment with a grain of 47 pounds for the dinitro over no treatment. The Endothal treatment gave approximately the same yield as the dinitro treatments but harvesting was delayed three days longer due to the slower curing. (Contribution of Kansas Agricultural Experiment Station.)

Sodium cyanamid, Dalapon and Endothal used as pre-harvest sprays on wheat. Zalik, Saul Sodium cyanamid (X5) at 15 and 30 lb/A active ingredient, Dalapon (a,a, dichloropropionic acid) at 6 and 12 lb/A acid equivalent, and endothal S - 4069 (3,6 - endoxohexahydrophthalate) at 1.5 and 3 gal/A were applied to Red Bobs wheat at two dates. The grain had about 46% moisture at the first date of spraying (August 17, 1953) and about 23% moisture at the second (September 8, 1953). The yield and wt/bus on all plots treated at the first date, except the 6 lb/rate of Dalapon, was markedly reduced. Thus moisture drop was accompanied by severe shrinkage. Spraying at the second date had practically no effect on yield or wt/bus, and the crop in moisture was no greater than for the check plots. Two days after spraying at either date, the straw and heads of grain treated with X5 took on a golden brown color and those treated with endothal a characteristic silvery-grey color. Moisture tests did not show this coloration to be an indication of a drop in moisture. (Department of Plant Science, University of Alberta, Edmonton.)

NEW HERBICIDES

W. C. Dutton

Summary

Fifty abstracts on twenty so-called new chemicals were received. This group includes chemicals that are relatively new in the herbicide field as well as some older compounds that were used in exploratory work in attempts to find answers to problems not taken care of by available materials. Several materials not yet widely recommended for use, but which have been studied widely for two or three years, were not included this year in the New Herbicide list. Results from their use are presented under suitable project headings and, in fact, no abstracts are being published in the New Herbicide section.

The summary which follows is an attempt to indicate the possibilities and limitations of the new materials. The number of reports received for each material is shown and this should give some indication of dependability of the conclusions stated which are based entirely on the evidence presented by the author of the abstract and are not interpretations by the summarizer.

Alpha-cyano-beta-(2,4-dichlorophenyl) acrylic acid (1 report) was used as an ester and an amine salt at 2-1/2, 5 and 10 lb./A. on wild oats in the 2 to 3 leaf stage with very little effect. Sodium trichloro acrylate (2 reports) applied to wild oats at 9 to 12 in. height gave no control at 2 lb., moderate control at 8 lb./A. and there was no injury on sugar beets from 8 lb. Trichlorobenzoic acid, the isopropyl ester (2 reports) when used on onions as a pre-emergence treatment at 8 lb./A. gave good control of lamb's quarters and purslane, no control of pigweed, smartweed and grasses, and gave no significant reduction in stand or yield of onions. A post-emergence application of 8 lb. on onions had some effect on weeds with no reduction in yield. Trichloroacetanalide (2 reports) used on wild oats at 9 to 12 in. height had no effect at 2 lb. and moderate control at 8 lb./A. On sugar beets at the 12 leaf stage, 2 and 8 lb. caused no injury. Hexachloroacetone (2 reports) on wild oats at jointing stage (9-12 in.) gave no control at 2 lb. and moderate results at 8 lb. and on sugar beets at 12 leaf stage caused no injury at 8 lb.

3,4-Dichlorophenoxyacetic acid (2 reports) was used on flax for annual weed control. Flax yields were reduced by the ester, and the amine delayed blossoming and growth and weed control was not equal to 2,4-D and MCP. Used on corn, 3,4-D gave best results as an early post-emergence treatment. Later treatments were effective on broadleaves at higher rates but grasses were not controlled.

4-Chlorophenoxyacetic acid (8 reports) gave variable and rather confusing results. It was generally less effective in weed control than 2,4-D and MCP and in some instances gave poor weed control. It is probably safer on legumes than 2,4-D and MCP but safe rates were generally ineffective against weeds. There is some evidence of specificity. On flax it delayed maturity and did not control the weeds. Beta-naphtoxy acetic acid (2 reports) was used for the control of Russian pigweed in legumes. Alfalfa, red and sweet clover (1-1/2 in. high) were tolerant to 4 oz./A. but this did not control pigweed. An application one week later caused more injury to legumes and the pigweed was more resistant to all

treatments.

2,4,5-Trichlorophenoxyethyl sulfate (6 reports) killed sugar beets without controlling the weeds; 4 lb. (pre-emergence) caused temporary stunting of corn with control of broadleaves but not grasses and in soybeans it stunted the beans but was ineffective for weeds. Wild oats were not controlled by 20 lb./A. disked into the soil. Six pounds in an established nursery gave fair to good weed control with no injury to nursery plants. Four pounds gave 82% control and 8 lb. gave 93% in a conifer transplant bed without injury to conifers. 2,4,5-Trichlorophenoxyethyl benzoate (5 reports) was ineffective in soybeans at 1 and 2 lb. but gave fair to good control of grasses and broadleaves at 4 lb. and in corn 2 and 4 lb. gave excellent weed control with some temporary stunting. Eight pounds was safe in conifer transplants but gave poor weed control. In strawberries, compared with SES, at 6 lb., both failed in dry weather and both gave good weed control when rain followed. There was no effect on runner formation. Two and four pounds, pre-emergence, caused 2,4-D effects on early leaves of snap beans but not on lima beans. There was no yield reduction. 2,4-Dichlorophenoxyethanol (3 reports) used at 8 lb. in conifer transplants caused no injury but was ineffective for weeds and at 2 and 4 lb. caused formative effects on early leaves of snap beans and reduced yield. There were no formative effects on lima beans. Five pounds on sweet potatoes caused no injury and no yield reduction. Bis(dichloro)phenoxyethyl oxalate (1 report) was disked into soil for wild oat control. Five pounds gave no control.

Isopropyl-N-(3-methylphenyl) -carbamate (4 reports) caused temporary stunting of sugar beets with better control of broadleaves than of grasses and weed control was poor in soybeans at 8 lb. In greenhouse studies 2 lb. stirred into soil gave good control of wild oats but not of Setaria and in the field 2 lb. had no effect on oats but 12 lb. gave 100% control. Sugar beets tolerated 12 lb. but flax, corn and soybeans were injured. Sec.-butyl-N-(3-chlorophenyl)-carbamate (3 reports) used on soybeans at 4, 8 and 16 lb. pre-emergence was not equal to CIPC at 8 lb. Sixteen pounds gave 75 and 70% control of grasses and broadleaves, respectively. In greenhouse studies it gave 72 and 5% control of wild oats and Setaria, respectively, with little or no injury to crops and 16 lb. gave 100% control of both but with severe injury to corn, sunflower and soybeans. Field studies gave no control of wild oats at 2 lb. and 94% at 12 lb. but the 12 lb. rate caused injury to flax, corn and soybeans. Sugar beets were tolerant. Isopropyl-N-(2-Methoxy-5-chlorophenyl) carbamate (2 reports) gave poor weed control at 8 lb. in soybeans and in greenhouse studies 2 lb. was ineffective but 16 lb. gave 99 and 38% control, respectively, of wild oats and Setaria and caused moderate injury to crops. The general indication is that these three carbamates are not equal to CIPC.

Phenyl dimethylurea (14 reports) was reported for three studies on soybeans, all pre-emergence, with results as follows: (1) 1, 2 and 4 lb. more toxic at all rates than CMU and slightly less effective on weeds; (2) less effective than CMU at 1-1/2 lb. and about equal, or slightly better, at 2 and 3 lb. and (3) slightly less effective than CMU on grasses at 1 lb. Three experiments on corn gave: (1) good weed control with no injury at 2 and 4 lb., (2) CMU was better on foxtail and they were equal on broadleaves with both giving slight reduction in size of corn and (3) CMU gave better grass control than PMU. In sugar beets it was slightly more toxic to beets and slightly less active on weeds than CMU early in the season but both killed the beets later. Three experiments with wild oats gave: (1) 40% weed control with 1-1/2 lb. with a reduction in yield but in two other locations 1-1/2 and 3 lb. gave no weed control or injury; (2) in greenhouse tests CMU and PMU were alike,-both giving full control of wild oats and Setaria at 2 lb. but also killing soybeans, corn and sunflower and (3) in a field study

1/2 lb. was not effective but 4 lb. was good for weeds but was unsafe on corn, flax and sunflower; PMU looks very promising for weed control in carrots and low rates in combination with other chemicals are more effective and safer. Nimblewill in blue grass was only partially controlled with 8 lb. and blue grass was more sensitive than Nimblewill. Two applications of 1 lb. each in onions caused serious reduction in stand, 1 lb. pre-emergence caused no injury to sweet corn and 2 lb. gave good weed control throughout season in grapes and caused no injury or yield reduction. 1-(3,4-Dichlorophenyl)-3-methylurea (2 reports) as a pre-emergence in onions gave fair control of most broadleaves and 100% of pigweed and as a post-emergence treatment good control of pigweed, poor control of smartweed and reduced stand and yield of onions. 3-(3,4-Dichlorophenyl)-1, 1-dimethylurea (2 reports). In carrots 1-1/2 lb. gave 83% control of weeds, about like PMU and no injury to the crop. In onions control of broadleaves was good, of grasses poor and onion stand was reduced 56%. Trichloroacetylurea (1 report) used on wild oats in the jointing stage had no effect at 2 lb. and moderate effect at 8 lb./A.

Alpha, alpha-dichloropropionic acid, sodium salt (18 reports) was reported for a wide variety of uses and results will be indicated on the basis of individual crops and weeds in order to make the summary as concise as possible. Johnson grass. Twenty, 40 and 80 lb. at milk stage gave top kill of 90, 95, and 100% and reduction of live rhizomes and roots of 35, 30 and 82%; the same rates on regrowth gave top kills of 80, 90 and 95% and rhizome reductions of 60, 33 and 80% and on soil after mowing reduced plant count by 90, 94 and 99% and rhizomes and roots by 87, 86 and 94%, respectively. In another study 20 lb. on regrowth gave complete top kill in 5 weeks and 50 lb. was slightly faster and 40 lb. applied in flowering stage stopped seed formation. Johnson grass-alfalfa mixture sprayed just after first cutting with 0, 2-1/2, 5, 10, 20 and 40 lb. increased percentage of alfalfa in hay in second cutting from 60(check) to 76, 82, 92, 100 and 100% respectively. There was slight reduction in yield of alfalfa at 20 lb. and severe at 40 lb. The same rates gave similar, but better, results in another location. Quack or Couch grass. A June application of 5, 10, 20 and 40 lb. to quack in mixed clover and alfalfa gave 0, 0, 75 and 90% kill of quack; in another June application 10 lb. was a little low and 20 lb. was good; 17-1/2 and 35 lb. on soil and to quack in flower gave high degree of suppression but there were live rhizomes with all treatments; 6 lb. applied in early spring suppressed quack in alfalfa until first cutting and there was no regrowth of quack under fruit trees with 20 lb. Winter annual and annual grasses. Downy brome in alfalfa was well controlled by March and April applications of 3 lb. and more without injury to alfalfa. Established foxtail and crabgrass in soybeans were killed soon by 5 lb. and slowly, but eventually completely, by 2, 3 and 4 lb. Two reports indicate full control of foxtail with 5 lb. (lowest rate used), and two other reports show good control with 1 and 2 lb. and 100% with 4 lb. Sandburs sprayed in 2 to 3 leaf stage were controlled 30, 89, 88, 98 and 98% with 3, 5, 10, 20 and 40 lb., respectively. Purslane and pigweed were not controlled with 4 lb./A. (amine salt). Wild oats 4 to 5 in. high, were well controlled by 5 lb.; wild oats, 4 to 6 in. high, in flax were controlled 60, 90, and 90% by 1.6, 3.25 and 6.5 lb. (acid equivalent), respectively; wild oats in 5 leaf stage were stunted and seed production reduced by 4 lb.; severely affected by 5 lb. and wild oats, 3 to 4 in. high, were stunted some by 5 lb. and severely by 10 lb.

Crop tolerance to alpha, alpha-dichloropropionic acid varied widely. Alfalfa was not injured by 6 lb. in early spring treatments and only slightly by 9 lb. Ten pounds just after first cutting caused no reduction in yield and 20 lb. only slight. June application one week after first cutting of 5, 10, 20

and 40 lb. reduced established alfalfa 0, 0, 10 and 90% respectively. Red clover was reduced 50, 50, 80 and 90% by these treatments. Sugar beets showed only slight marginal "burn" from 8 lb. applied in 12 leaf stage. Flax treated with 1.6, 3.25 and 6.5 lb. showed some effect for 10 days. The two higher rates caused reduction in yield and all rates caused formative effects on flax roots. In a second study 5 and 10 lb. caused injury, especially the 10 lb. rate, and, in a third, 1, 2, 4 and 8 lb. caused a reduction in stand only at 8 lb. Wheat, in one case, was injured some by 5 lb. and more by 10 lb.; severe malformation was caused in a second case by 4 lb. and, in a third, 1 lb. killed 95% of the wheat. Oats were injured by 5 and 10 lb. Barley, oats, field peas and sunflower were injured by 5 lb. and more severely by 10 lb. Soybeans were severely stunted with low rates (2 to 4 lb. applied only to lower leaves and base of stem) and there was tremendous production of flowers at the nodes. Sweet potato suffered leaf injury and yield was reduced by 3 lb. applied five days after plants were set. Onions were not injured and yield was not reduced by 1, 2 or 4 lb. Fruit plants showed marked difference in tolerance. Apple and pear tolerated 40 lb. with only slight marginal injury to foliage. Sour cherry, plum and peach showed necrosis and chlorosis at 3 lb. and serious injury at 20 lb. and on grape 10 lb. was safe.

BASIC STUDIES

Summary

W. E. Loomis

Basic studies continue to lag behind applied work in herbicide research. Of the abstracts submitted this year, two are concerned with control of woody plants. They support the thesis advanced from work with basal sprays, that penetration of 2,4-D (or 2,4,5-T) into the root-crown area is essential for control of trees which sprout from this region but not from the roots. Elm and oak are in this class. Trees that form adventitious buds on the roots will ordinarily require repeated treatments to prevent replacement of root reserves by sprouts.

Translocation is still a difficult problem with the results measured in inches when we need yards. The data of Zick and Buchholtz indicate that MH was distributed through quack grass rhizomes within two days. Distances were presumably 8 - 10 inches. Gleason found dependable downward translocation of injected amine in trees to be limited to about two feet, although records of 10 feet were obtained occasionally. The action of urea in speeding absorption and translocation of 2,4-D is interesting, but not, as yet easily explained.

Experiments with 2,4-D on simpler plants are promising in basic work. Swanson found the stimulatory effect on yeast respiration to be associated with the formation of respirable substrates. Concentration-time-temperature studies give complicated results which are more indicative of adsorption and of denaturation of protoplasmic constituents than of stoichimetric combination of 2,4-D with specific growth sites.

Abstracts

Action of 2,4-D when injected under the bark of woody plants. Gleason, Lowell S. 2,4-D was applied to trees by injecting 1-2 ml. conc. sol. into hatchet cuts about 2 inches wide, which penetrated the bark and were spaced at intervals around the circumference of the tree. Readings were made a year later by removing the bark and observing vertical and latteral kill from individual applications.

When applied in this way the amine formulation was always better than the ester in both latteral and vertical spread and in root kill. Also, 2,4-D was better than 2,4,5-T or MCP. Treatment at full leaf in late May was most effective and mid-summer treatments least effective. The season from bud swell to full leaf was satisfactory. Notches 1 foot above the root crown gave generally good root kill while notches at 3 feet did not result in adequate downward translocation. Elm, oak, hickory and willow were killed by treatments at full leaf with notches 4-6 inches apart. Wider spacings did not give consistent kill. Honey locust showed very poor translocation and kill under all conditions. (Contr. Dept. Botany, Iowa State College.)

Soil injection of herbicides as a method of individual plant treatment. McCully, Wayne G. Application of herbicides beneath the soil surface at the base of individual second-growth post and blackjack oak has given good kills of trees having a stem diam. of less than 6 in. The herbicide was released adjacent to the primary axis of the plant 4 in. beneath the soil surface from a probe designed for this type of application. Complete kills of all trees treated during the period of leaf expansion were obtained with 8 lb ahg of a low-volatile ester of 2,4-D in diesel

oil. Test plants did not respond to an application of 16 lb. ahg of the same material in water. Similar results were obtained with equivalent applications of a low-volatile ester of 2,4,5-T. Volume of material applied seems more important than strength of solution. The same total volume of material injected on opposite sides of the tree gave as good kill as four injections around the stem. Further testing of this method is necessary to determine season of treatment, rate of application and other factors. A substantial reduction in cost of materials, a major disadvantage of basal application, by substitution of cheaper materials and reduction of the rate of application is indicated from results of preliminary tests. (Dept. Range and Forestry, Texas Agricultural Experiment Station. Approved as Technical Article No. 1834 by the Director, Texas Agricultural Experiment Station.

Responses of yeast to 2,4-D. Swanson, C. R. A cellular approach to the physiology of 2,4-D action was adopted by using yeast as the test plant. Growth of yeast was not stimulated by any concentration of 2,4-D, but marked inhibition was obtained with 10^{-3}M at pH 6.0 and complete inhibition occurred at $2x10^{-2}$M. Recovery of growth, on removal of the yeast from 2,4-D, was dependent upon the concentration and the duration of treatment. Below the critical time-concentration effect there was apparently a direct relationship between growth and degree of saturation of the growth sites with 2,4-D. Above the critical time-concentration the complete cessation of growth seems to be best explained by postulating a destruction or alteration of the normal protoplasmic structure.

Aerobic, endogenous respiration was stimulated over a narrow range of 2,4-D concentrations. High RQ values were obtained only at inhibitory concentrations. Aerobic, exogenous O_2 uptake was progressively inhibited with increasing concentration of 2,4-D, but the inhbititory effect was maintained only at concentrations of glucose at or above the optimum for yeast respiration. Anerobic, endogenous CO_2 evolution was stimulated by 2,4-D, indicating an induction of endogenous fermentation. At equivalent concentrations, anaerobic, exogenous CO_2 evolution was not affected.

It is postulated that 2,4-D probably acts through the stimulation of fermentation of reserve polysaccharides, with a simultaneous inhibition of the oxidative, synthetic processes involved in growth, possibly through an uncoupling of phosphorylation from oxidation. Stimulated endogenous respiration may be attributed to the accelerating effect of 2,4-D on the dissimilation of reserve carbohydrates, resulting in an increase in respirable substrate. The reduction of exogenous respiration by 2,4-D may be due to an interference with glucose absorption, or may indicate a direct interference with respiratory processes which is not evident when the substrate is limiting in endogenous respiration.

It was shown that the total concentration of 2,4-D required to produce maximum stimulation o. 50 percent inhibition of respiration decreased greatly as the pH of the medium was lowered. On the basis of undissociated 2,4-D, however, a narrow range of concentrations was required to produce a standard response over the pH range employed, indicating that penetratinn is limited largely to the undissociated 2,4-D molecule. The activity of 2,4-D may be dependent upon the internal pH of the cell and the concentration of 2,4-D ions within the cell..(Contribution Botany Department, Iowa State College, and Division of Weed Investigation, BPISAE, USDA)

The additive effect of urea on the physiological activity of 2,4-D acid. Switzer, C. M. and Bibbey, R. O. The additon of urea to solutions of 2,4-D increased the response of bean and buckwheat plants to this herbicide. This additive effect was noted both when the urea and 2,4-D were mixed before application, and when they were applied to the plant within 6 hours of each other. The response was not increased when the treated plants were washed between application of the two materials, or when urea was applied to one part of a leaf and 2,4-D to another. A concentration of 0.5% urea appeared to be optimum for use in the mixture. This concentration increased the apparent activity of all concentrations of 2,4-D with which it was mixed, with maximum additive effect at 300 ppm of 2,4-D.

Urea increased plant responses to 2,4-D acid and to its sodium, ammonium and alkanolamine salts. This additive effect was apparently not related to a change in the surface tension of the 2,4-D solution, or to a nutritive effect of the foliar-applied urea, or to the formation of a simple ammonium-type compound. The addition of urea increased both the speed of absorption and the total amount absorbed. Whether the resulting additive effect was due to an increase in the amount of the urea - 2,4-D mixture translocated, or an increase in the speed of this translocation, was not determined. Experiments with Avena coleoptiles and intact plants indicated that the primary activity of the mixture was no greater than that of 2,4-D alone.

Injury to the tissues by the urea - 2,4-D mixture appears to be an important factor in bringing about an increased absorption of the 2,4-D component. (Contr. Dept. Botany, Ontario Agricultural College.)

Chemical analysis of stumps and roots of Post Oak (Quercus stellata) to determine amounts of solids and carbohydrates reserves at different stages of activity. Webster, J. E., Dreessen, Jack and Elder, W. C. In November, 1951, 12 post oak trees of 10 inches diameter were selected and assigned at random to four treatments of three trees each. Three trees were left standing, three were sawed off at a height of one foot and sprouts were broken off as they appeared, three were sawed off and the sprouts were allowed to grow, and three were sawed off and the stumps treated with a heavy concentration of 2,4-D and 2,4,5-T esters in diesel oil. Samples were taken bi-monthly, except at the beginning of plant activity in the spring when samples were taken each month. Standing trees and stumps were bored into with a one inch wood bit and the shavings were collected from each tree. Bored holes were plugged with cork stoppers. A large root of each tree and stump was exposed and bornings were made. A composite sample of shavings from roots of each of the three trees that received the same treatment was collected. After two years, standing trees show no effect from sampling. Untreated stumps still show activity, with regrowth prominent. Treated stumps apparently are dead, with very little regrowth appearing. Chemical analyses were run on each sample to determine water, ash, reducing sugars, sucrose, total sugars, acid-hydrolyzable material, starch by diastase, alcohol soluble nitrogen, total nitrogen, and soluble solids. Results of the determinations indicate very little difference between treatments in acid-hydrolyzable material, soluble sugars, soluble solids, or total nitrogen in the roots or stumps. Some factor other than the supply of available carbohydrates and nitrogen is causing the treated stumps to appear dead. Soluble solids and sugars reach a minimum in the roots in mid-summer and increase several fold in the late fall and mid-winter. Acid-hydrolyzable material reaches a low one to two months earlier. Sugars are low from March to late summer and reach a peak in the fall and mid-winter. Starch apparently makes up about one-sixth of the acid-hydrolyzable material in the stumps and trees, and about one-half to one-third in the roots. Roots contain about one-third more acid-hydrolyzable material than do the stumps or trees. Nearly all of the sugars are reducing sugars. Variations in soluble

materials from one tree to another are greater than variations from one treatment to another. (Contr. Oklahoma Agriculture Experiment Station.)

Translocation of maleic hydrazide into quackgrass rhizomes. Zick, W. H. and Buchholtz, K. P. A dense stand of quackgrass with 4 to 6 inches of leaf growth was sprayed on July 21, 1952 with a 16 lb/A application of the sodium salt of MH in a water solution equal to 40 gals/A. The day after treatment and at varying intervals thereafter rhizome material from treated and check areas was dug at random, separated from the soil and washed. Rhizome sections of at least six nodes and attached to green shoots were selected. These sections were cut into one-node segments and the original position of the segments on the rhizome maintained, numbering from the shoot. Twenty-five segments were secured for each rhizome position on each date of sampling for the treated and untreated plots. Three replications were used. The rhizome segments were planted in flats and covered with two in.of black soil. The flats were sunk to ground level in a fallow area and moisture kept at an optimum level. Six weeks after each series was set out the flats were taken up and the quack grass shoot growth observed and measured. Percent of check values were calculated for each position of the node, and for the average of all nodes. The data in the table show that the translocation of MH into and through rihzomes was very rapid, Under the conditions of this experiment the maximum inhibition of shoot growth was obtained between the fifth and seventh day following application of MH. A considerable amount of the inhibition was lost within a few days after reaching its peak.

Position of node	Shoot growth and intervals after treatment-pct check							
	1 day	2 days	3 days	5 days	7 days	9 days	11 days	18 days
2	56.9	51.2	43.2	25.2	33.6	51.2	61.7	58.8
3	63.4	49.1	43.0	29.2	41.9	44.6	58.9	60.5
4	63.4	57.1	41.1	37.4	32.8	58.8	67.9	70.5
5	67.8	43.2	44.7	35.5	31.6	48.0	74.8	67.6
6	82.4	52.9	43.4	32.2	37.6	53.2	59.9	74.2
Ave.	66.8	50.7	43.1	31.9	35.5	51.2	64.6	66.3

(Dpt. Agron., Univ. Wisconsin)

MECHANICAL CONSIDERATIONS

Summary R. E. Larson

The several abstracts submitted for inclusion in this section as dealing with the mechanical problems of weed control cover a wide field. Included are results of work on aerial application of herbicides, ground application of herbicides, and mechanical treatment.

There are three abstracts of the results of work on the aerial application of herbicides. In work done in Alberta, it was found that yields from aerially treated plots were not significantly different from untreated plots where there were no external conditions which would upset the growth conditions in the plant. In observations of two field sprayings, it seemed apparent that hail and wind prior to the spraying were vital factors in producing head sterility in the crop plants.

In studies of ground vs. air application and oil vs. water carriers at South Dakota, there appeared to be little consistent difference between water and oil or between air and ground applications. The most consistent treatment was an oil application by air at 5 gal/A which gave significant increases in 5 of 6 treatments thus applied. In the same tests, studies were made of the butyl esters, mixtures of isopropyl esters and butyl esters, and ethyl esters of 2,4-D. The only results given thus far for these tests indicate that in the year when there is ample soil moisture, the yields are not increased by controlling sunflowers, the biggest advantage apparently being that the harvesting is facilitated. These plots showed that sunflowers were present but had been stunted varying degrees by the herbicide and showed regrowth in some plots.

In the mechanical treatments reported, Michigan State has reported a unique method of weed control which involves the killing of the germinated weed seeds by imparting kinetic energy to the soil and throwing it at high velocity against an impact plate. This apparently is rather successful on those weed seeds which have germinated.

A report on the design of sugar beet thinners indicates that a double counter-rotating spring-tine head thinner produces the same results in one operation that is gained by two operations by most commercial machines. This machine was also equipped with a variable speed drive to permit the operator to adjust the speed of the rotating heads with respect to the stand of plants in a row.

Abstracts from Missouri and Iowa concerned with the improvement of application of herbicides, through the use of rollers and land smoothing devices as an aid to the use of pre-emergence herbicides in soybeans and corn, find that under favorable conditions such methods gave weed control equal to, but no better than, unworked areas. On the other hand, where a rain was encountered between the time of treatment and the time of emergence, the rolling on soybeans caused crusting of the soil surface and as a result did reduce the stand.

In a study of the methods of application of post-emergence herbicides in soybeans, skids, drop pipes, and boom mountings were compared with results showing little or no differences in yield as affected by method of placement of the herbicide. With the chemicals used being CMU, DNOSBP, and CIPC at comparable rates, the chemical rather than the method of placement was the deciding factor affecting yields.

Aerial spray application of 2,4-D in oils. Sexsmith, J. J. Two aerial spray tests were conducted in 1953 with the Lethbridge Experimental Station, Imperial Oil Ltd., and private farmers cooperating. In both tests three special oils were compared with commercial diesel fuel and untreated check strips. Duplicate plots 4 x 320 rods were treated by boom-equipped aeroplane at a rate of 4 oz. acid equivalent of ester 2,4-D in 2 quarts (Imp.) oil per acre. Specifications for oils were: No. 1 - white oil, 0-5% aromatics; No. 2 - non-cracked oil, 20-30% aromatics; No. 3 - cracked oil, 70-80% aromatics; No. 4 - commercial diesel fuel oil. There were very few weeds present, and both tests were considered as weed-free.
Test 1 - Marquis wheat, on dry land in the brown soil zone (silty loam), was in early shot-blade when treated. Yield samples were harvested for 14 ft. x 300 rod area for each plot. Average yields in bu/A for two replicates were: No. 1 - 26.1, No. 2 - 24.2, No. 3 - 28.7, No. 4 - 26.6, Untreated Check - 31.2. Head tip sterility noted for No. 2, much as seen in damaged crops in 1951, but less severe. All treatments caused some yield reduction, being most severe for the 2,4-D in non-cracked oil of 20-30% aromatic content, The comm. diesel caused reduction of 4.6 bu/A. Samples were graded by government grader; untreated check samples graded slightly better than others and all sprayed samples were noted as having immature and "hail damaged" kernels.
Test 2 - Compana barley, on dry land in brown soil zone (heavy loam), was up to early boot (av. ht. 14 in.) when treated. Yield samples were harvested for 15 ft. x 160 rod area for each plot. Average yields in bu/A for two replicates were: No. 1 - 55.4, No. 2 - 54.0, No. 3 - 53.2, No. 4 - 55.5, Untreated Check - 54.8. No sterility as result of treatments was noted in this test.
General - Only one treatment in the two tests gave any noticeable degree of head sterility. Observations made of several spray jobs in Southern Alberta in 1953 showed varying amounts of sterility; in two cases, amount was quite marked. In one instance, Rescue wheat was sprayed 3 days after hail. The crop browned up within 2 days, later recovered, but exhibited considerable head sterility. In the other instance, a high wind occurred 3 days after spraying, with approximately the same outcome. Further, greater amount of sterility occurred in crop on fallow than in crop on stubble. Possibly any condition likely to cause upset in the plant at or near time of spraying may predispose the plant to sterility damage from 2,4-D-oil application. (Contributed by Dominion Experimental Station, Lethbridge, Alberta.)

Effect of different rates of application of 2,4-D on weed infestation and yield of spring wheat. Wallace, Keith E. and Derscheid, Lyle A. Quadruplicate plots (1 x 5 rods for ground and 45 feet x 5 rods for air) were treated at Stroel (in northwestern S.D.) June 10 and 11 with wheat in 5- to 6-leaf stage and Huron (in central S.D.) June 17 (ground) and 22 (air) with wheat in 7-leaf stage. Butyl ester of 2,4-D (oil miscible, 6 lb/gal), a mixture of isopropyl and butyl esters of 2,4-D (oil or water emulsifiable, 4 lb/gal) and ethyl esters of 2,4-D (oil or water emulsifiable, 3 lb/gal) were applied at 1/8, 1/4, 1/3, 1/2, and 3/4 lb/A using 1 gal. heater oil (for air) and 10 gal. water (for ground) as carrier. Five sq. yd. samples were cut, yields were calculated in bu/A and data were analysed statistically. Yields were not significantly different in treated plots than in the untreated weedy check; indicating that in a year when ample soil moisture is available, yields are not increased by controlling sunflowers, but harvesting is facilitated. Weed readings were made at time of harvest, wild buckwheat and sunflowers were present. Sunflowers had been stunted in varying degrees with regrowth in some plots. (Contributed by Agronomy Dept., South Dakota State College, Brookings, S.D.)

Effect of ground and air application with four volumes of carrier.
Wallace, Keith E. and Derscheid, Lyle A. Quadruplicate plots (1 x 5 rods for ground and 45 feet x 5 rods for air) were treated with 2,4-D at 1/3 lb/A at two locations (Strool and Huron, S.D.). Split plot design was used, with volumes as main plots and treatments as sub plots. Application was made June 10 and 11 at Strool (in northwestern S.D.) and June 17 (ground) and 22 (air) at Huron (in central S.D.). Wheat was in 5- to 6- leaf stage at Strool and 7- leaf stage at Huron at time of application. Spray retention data were collected by application of dye with the treatment and washing samples cut following treatment. These data are not completely analysed and will not be presented at this time. Five sq. yd. samples were cut and yield data were calculated in bu/A. These data were analysed statistically and are compared to the unsprayed weedy check in the chart below.

		Strool				Huron			
Carrier and Method	(3) 2,4-D	(2) N	(4) 2.5	(4) 5	(4) .5	(2) N	(4) 2.5	(4) 5	(4) .5
F(1) oil air	A	6.5**				5.3			4.8
F(1) oil air	none								5.3
Oil air	C	8.8**	9.5	15.4**	5.5	5.9	4.9	6.8**	5.1
Oil air	A	8.4**	8.9	13.7*	7.7	5.4	4.5	4.6	5.4
Oil air	none	15.9	10.0	15.3**	5.8	6.5	4.4	6.0*	6.0
Oil ground	C		9.4	10.6			4.3	4.3	
Oil ground	A		7.2**	9.4			4.1	4.3	
Oil ground	none		8.2*	6.5			6.4	5.8*	
Water air	C	12.3	6.8**	10.3	5.3	4.7	5.0	5.3	5.8
Water air	B	14.9	9.8	9.2	9.2	5.8	6.2	4.4	7.5
Water air	none	16.1	7.3*	11.4	5.7				
Water ground	C	15.3	8.6	8.6		4.0	5.5	3.6	
Water ground	B	12.1	7.0**	9.6		5.4	4.5	6.5	
Water ground	none	12.8	8.4	8.4					
Check		17.5	11.4	5.2	8.0	5.5	5.4	3.9	6.2
Average		12.8	8.6	10.3	6.7	5.4	5.0	5.0	5.8
Within vols.									
LSD .05		6.4	3.1	6.6	3.6	2.6	2.1	1.7	3.1
LSD .01		8.6	4.2	8.8	5.0	3.5	2.8	2.3	4.2

* Significantly different from untreated weedy check at .05 level
** Significantly different from untreated weedy check at .01 level
1. Furnace oil
2. Normal volume includes 1 gallon for air and 10 gallon for ground
3. Key to 2,4-D used
   A. Butyl ester of 2,4-D, oil miscible, 6 lb/gal.
   B. Mixture of isopropyl and butyl esters of 2,4-D, oil or water emulsifiable, 4 lb/gal.
   C. Ethyl ester of 2,4-D, oil or water emulsifiable, 3 lb/gal.
4. Gal/A

Weed readings were taken at time of harvest, sunflowers and wild buckwheat were present and stunted as compared to unsprayed weedy check. There was regrowth on some plots. (Contributed by Agronomy Dept., South Dakota State College, Brookings, S.D.).

Mechanical sterilization of soil strips for weed control, Carleton, Walter M. A proposed solution to the control of weeds in the row (and attendant hand labor) was the physical processing of a strip of soil to be laid down directly behind the planting mechanism and over the (sugar beet) seeds. This project is now (1953) in its third year. Consideration of factors governing germination indicated that weed seeds not yet swollen and seeds deep in the soil were of no immediate concern.

Three methods of physical processing were investigated: (1) heat energy, (2) ultrasonic energy, and (3) mechanical energy. Heat energy was soon dropped from consideration because of the large heat requirement. Ultrasonic energy was investigated at some length, both analytically and experimentally. Although data showed clearly that ultrasonic radiation produced considerable effects on the seeds other than heating, the method was dropped in favor of a more detailed study of the application of mechanical energy.

An instrument was built for mechanically imparting kinetic energy to the soil and to throw it at high velocity against an impact plate. Strips of soil, one inch in depth and containing known seeds, were processed in the laboratory. The results showed that only a small percent of the germinated seedlings came up in the processed strip.

An experimental planter was modified for field tests. Preliminary trials during the summer of 1953 reflect principally equipment difficulties. Further laboratory and field tests are planned for the winter and summer of 1953-54. References: Kinch, D. M., "Physical Factors Affecting the Germination Vitality of Weed Seeds," Ph.D. degree, Mich. State College, Winter 1953; Kinch, D. M. and Walter M. Carleton, "Soil Treatments for Weed Control," Proc. of Seventh Regional Meeting of Amer. Soc. of Sugar Beet Tech. East. U. S. & Canada, Detroit 1953. (Contributed by Agrl. Engr. Dept., Mich. State College and USDA - BPISAE, Farm Mach. Div., cooperating, East Lansing, Michigan.)

New concepts in design of sugar beet thinners. Carleton, Walter M. Weed control in the row and random stand reduction make possible considerable saving in labor. A power-take-off driven two-row machine designed and constructed by G. W. French, utilizes double counter-rotating spring tine heads and produces, in one trip across the field the same degree of weeding and thinning as gained in two operations by most commercial machines. Being tractor mounted it was readily kept on the row. Satisfactory depth control was obtained by location of depth gauge wheels directly over the row. A variable speed drive permits the operator to quickly change tine speed, without interruption of forward travel, in order to equalize stands of plants in the row. Reference: French, G. W., "A Double-Counter Rotating-Head Mechanical Sugar Beet Thinner." (Contributed by Agrl. Engr. Dept., Mich. State College and USDA - BPISAE, Farm Mach. Div., cooperating, East Lansing, Michigan.)

The use of rollers as an aid to the use of pre-emergence herbicides on soybeans. Larson, R. E., and Klingman, D. L. Investigations were conducted to study the possibility of using a roller to break up the lumps and pack the soil over the planted row and thus provide a smooth surface for the application of the pre-emergence herbicides. The roller used was concrete-filled, rubber-covered, 18 inches in diameter with a rim 12 inches wide. The chemical treatments in this test included three rates each of CIPC, DNOSBP, phthlamic acid and sodium PCP. These tests were repeated at two locations.

The results at one location indicated that where the top soil was fairly dry at the time of planting and remained dry until the emergence of the crop, the rolling was equal to, but no better than, the unrolled plots. In the trial at the location where a rain was encountered between the time of treatment and the time of emergence, the rolling caused crusting of the soil surface and as a result did reduce the stand and yields. In the checks with no chemical treatment the rolled plots had more weeds than the unrolled plots, however, in plots given chemical treatments, the weed control was equal. (Contributed by Divisions of Farm Machinery and Weed Investigations, BPISAE, U. S. Dept. of Agri., and Univ. Mo. Exp. Station cooperating, Columbia, Mo.)

Methods of application of post-emergence herbicides on soybeans. Larson, R. E., and Crumpacker, J. D. Studies of methods of application of post-emergence herbicides included the use of skids, drop pipes, and boom mountings to determine their influence on the effectiveness of post-emergence herbicides as the result of the placement variation affected by each method. The skid method provided a nozzle on each side of the row with the nozzles mounted about 6 inches above the ground surface and directed back and downward such that each nozzle sprayed a strip 20 inches wide with a minimum of overlap at the base of the soybean plant. The drop-pipe method suspended three nozzles about 10 inches above the ground between rows with the center nozzle in a normal position and the two side nozzles set at an angle such that they would place the spray under the leaves and close to the soybean stem. The boom mounting had the nozzles spaced at 40 inches on the boom and was set at a height which would allow the nozzle to cover only that portion of the ground between the rows which was not shaded by the leaves of the soybean plant. The chemicals used in this study were CMU at 1 lb/A, DNOSBP at 7½ lbs/A and CIPC at 10 lbs/A.

Yield results show no significant differences in the methods of application for the three chemicals. Visual observations indicated that the placing of the CMU close to the stem of the plant did cause those plots to show dry or dead leaves earlier than the plots of the other chemicals or the other placements of CMU. There was some defoliation of the lower leaves with drop pipes and skids. (Contributed by Division of Farm Machinery, BPISAE, U. S. Dept. of Agri., and the Dept. Agric. Engr. Univ. Mo. Exp. Station, cooperating, Columbia, Mo.)

The effect of soil preparation prior to applying pre-emergence sprays. Lovely, W. G. A fall plowed alfalfa sod was disked and harrowed in the spring before planting. Corn was hill-dropped on May 24, 1953, in 42" rows on Webster-Clarion soil with a 4-row planter. Land leveling and smoothing treatments were as follows: planter packing wheels, weighted wooden float, rotary hoe pulled backwards, and a cultipacker type roller. All plots received a pre-emergence application of 2,4-D ester at the rate of 1½ lbs. acid equivalent/acre in 10 gal. of water. The 1st cultivation was delayed until the corn was 12" - 15" high. This plus the subsequent lay-by cultivation gave excellent control of weeds. The soil clods were relatively small at the time of planting being in the range of ½" to 2" diameter. These clods were easily broken up and the wooden float produced the smoothest surface. The weed infestation on these plots was graded several times following the lay-by cultivation. The results show no difference in weed control. The extra work of preparing a smooth, clod free surface on which to apply the pre-emergence spray was wasted effort when measured in terms of weed control or in yields. The irregularities of soil surface produced by the various leveling treatments did nothing to add to or detract from the effectiveness of the pre-emergence spray. Stand and yield analysis showed no difference between treatments. (Contributed by Div. of Farm Machinery, BPISAE, U. S. Dept. of Agri., and Dept. of Agri. Engr., Iowa Agri. Exp. Station, Ames, Iowa.)

Experimental corn plot harvesting equipment. Lovely, W. G. and Collins, E. V. To facilitate machine harvesting of corn plots, a trailing picking-box and a tractor-mounted weighing box were constructed. Both boxes have a maximum capacity of 10 bu. of ear corn. The picking-box is track - and roller-mounted so that it can be pulled to one side and tipped to a 45 degree angle. One end is top hinged so that the ear corn empties easily and cleanly into the weighing box. Spring-loaded catches keep the end closed and the box in place while the picker is in operation. The tractor with the weighing box attached is driven up to the side of the picking box, so that the tipping action forces the ear corn to slide into the weighing box. The moisture sample corn sheller, the wagon elevator and the power take-off drive mechanism, as well as the weighing box, are attached to the tractor by a rectangular shaped tubular framework. A short, self-cleaning elevator is included in the weighing box and is used to transport the ear corn to the wagon elevator. This box is suspended from the framework by a parallel mechanical linkage and needle bearings. The linkage between the weighing box and the scale gives a 10 to 1 ratio so that a 60 lb. reading on the dial spring scale indicates 600 lbs. of ear corn. The scale used is graduated in 1/10 lb. units and this gives the actual weight in 1 lb. increments. Two men can harvest corn plots more than twice as fast as three men did with former equipment. The picker operator harvests the corn plot into the picking box and stops the forward motion to allow the picker to clean out. While the picker is being cleaned the second operator drives forward to the correct transfer position, then dismounts and dumps the picking box leaving the picker operator free to start on the next plot. The weight is secured and recorded, the elevators are started and ten ears are put through the sheller for a moisture sample before proceeding to the next plot. (Contributed by Division of Farm Machinery, BPISAE, U. S. Dept. of Agri., and Dept. of Agri. Engineering, Iowa Agri. Exp. Station, Ames, Iowa.)